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13. ABSTRACT (Maximum 200 words) <p>IN OCTOBER, 1984, THE ARMY PROPOSED A MAJOR COMPREHENSIVE REMEDIAL ACTION STRATEGY TO ABATE CONTAMINATION AT RMA. THE PROPOSED STRATEGY WOULD INVOLVE CLEANUP OF 16 MILLION CUBIC YARDS OF SOIL AT 88 SITES. PHASE I OF THIS PROGRAM HAS BEEN ORGANIZED INTO THE FOLLOWING SEVEN ELEMENTS:</p> <ol style="list-style-type: none"> 1. REMEDIAL INVESTIGATIONS 2. ENDANGERMENT ASSESSMENTS 3. FEASIBILITY STUDIES 4. DESIGN AND EXECUTION 5. OPERATION AND MAINTENANCE 6. PROGRAM MANAGEMENT 7. PROGRAM SUPPORT. <p>THIS TECHNICAL PLAN PROVIDES AN OVERVIEW OF THE CONTAMINATION PROBLEMS, PROJECT SCHEDULES, AND TASK DESCRIPTIONS. THESE DESCRIPTIONS SUMMARIZE THE OBJECTIVES AND KEY ASPECTS OF EACH TASK.</p>				
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ROCKY MOUNTAIN ARSENAL REMEDIAL ACTION STRATEGY

PHASE 1 TECHNICAL PLAN

Rocky Mountain Arsenal
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ROCKY MOUNTAIN ARSENAL REMEDIAL ACTION STRATEGY

PHASE 1 TECHNICAL PLAN

ROCKY MOUNTAIN ARSENAL REMEDIAL ACTION STRATEGY
PHASE I TECHNICAL PROGRAM PLAN

EXECUTIVE SUMMARY

In October 1984 the Department of The Army (DA) proposed a major comprehensive remedial action strategy to abate environmental contamination from past operations at Rocky Mountain Arsenal (RMA). This strategy has been fully coordinated with the US Environmental Protection Agency (EPA) and has been presented to the state and local governments and to the public. As proposed, this strategy would continue control actions that have been constructed or planned for containment of contamination on the Arsenal. The proposed strategy would involve cleanup of all buildings and near-surface soils, estimated to consist of 16 million cubic yards in approximately 88 sites at the Arsenal. Some of the material may be treated prior to disposal. Incineration technology will be assessed to select, evaluate, and demonstrate large-scale incineration technology that would reduce both the amount of material to be landfilled or would detoxify organic contaminants. Advanced technology such as in-situ decontamination is being pursued wherever technically feasible and cost-effective. All remaining contaminated material would be placed in a containment facility(s) covering a total of approximately 1 to 2 square miles. Facilities would be constructed in compliance with all applicable and relevant environmental regulations and would consist of state-of-the-art above-ground vault technology to preclude the possibility of future contaminant release to the environment. Temporary ground water restrictions on the Arsenal would be required. The ground water containment/treatment systems would continue to remain in operation to treat and discharge clean ground water off the installation. It is estimated that soil and building cleanup actions could be completed within fifteen years. Operation and monitoring of the various control systems would be required as long as necessary to control future contaminant release to the environment.

Execution of the remedial action strategy would occur in five phases, shown in Figure 1 (RMA Installation Restoration Program Schedule). To ensure that this strategy is conducted in an expedited fashion, bringing together resources both within the Army and outside the Federal Government, the Army is establishing a Program Manager (PM) to centrally manage all contamination-related efforts at the Arsenal. The PM will report directly to DA Headquarters and will be empowered to task the numerous elements within the Army community as needed to accomplish the PM's mission.

The technical program plan develops tasks, time-lines and resource requirements for Phase I of the strategy. Phase I has been organized into the following seven elements:

- o Remedial Investigations
- o Endangerment Assessment
- o Feasibility Study
- o Design and Execution
- o Operation and Maintenance
- o Program Management
- o Program Support

Remedial Investigations determine the nature and extent of the contamination and gather necessary data to support the Feasibility Study. At RMA, much of the work that would normally be accomplished in the Remedial Investigations has been completed. Thus, Remedial Investigation tasks described in this plan are work that remains to be completed.

The Endangerment Assessment, a component of the Remedial Investigations/Feasibility Study, determines the magnitude and probability of actual and potential harm to the public health or environment from the release of contaminants. It is based largely on information collected in the Remedial Investigations and analyses conducted in the Feasibility Study.

The Feasibility Study develops and evaluates remedial alternatives for abating contamination. In the evaluation of alternatives, both existing equipment and technologies will be examined as well as advanced technologies that could make remedial actions more efficient and less costly. Pilot or demonstration studies will be conducted to evaluate or confirm performance and to develop design criteria.

The Design and Execution (construction and/or cleanup) element includes development of design criteria, final design of remedial facilities, control actions addressing source area and migration pathways in order to protect the health of the public and/or to satisfy regulatory compliance, and off-post remedial actions. On-post activities will include:

- o Plugging deep well;
- o N and NW boundary system alterations;
- o Waste salts disposal;
- o Fugitive dust control;
- o Basin F closure;
- o Lower lakes sediment removal; and
- o Upgrade sanitary sewer.

Off-post activities include installation of monitoring wells, sampling and analysis, and assessment of applicable alternatives. Based on the Army's experience at other installations, advanced water treatment and/or distribution systems may be selected to provide water to offsite houses.

Operations and Maintenance includes continuation and completion of work to operate and maintain existing control systems and to

eliminate potential sources of pollution.

Program Management includes the PM's office and the immediate staff needed to support the PM. Staff elements include engineering operations/monitoring and technical coordination.

Program Support involves a variety of activities that must be available to support the operational tasks underway. It includes such things as permitting, legal support, community relations, data management, resource management, logistics, systems analysis, chemical analysis, quality control, criteria development, and health and safety.

Time-lines that include all tasks were developed for each phase; Phase I is FY 1985 through FY 1989. These schedules are controlled by three milestones:

- o Program Manager decision on remedial alternatives: Mar 87
- o Initiation of construction: Oct 89
- o Initiation of full scale decontamination (Phase II): Oct 90

ROCKY MOUNTAIN ARSENAL REMEDIAL ACTION STRATEGY
PHASE I TECHNICAL PROGRAM PLAN

INTRODUCTION

The purpose of this chapter is to present an overview of the Army's environmental program at Rocky Mountain Arsenal (RMA) and to describe the proposed RMA remedial action strategy Phase I (FY 85-89) Technical Program Plan.

There are two main sections in the chapter. The first section is a technical program overview which contains background information and history as well as a description and schedule for the proposed overall remedial action strategy. The second section describes the proposed Phase I Technical Program Plan and includes both schedules and time-line presentations of the various components and estimates of resource requirements. Specific task descriptions for the Phase I Technical Program Plan are in Appendix B.

TECHNICAL PROGRAM OVERVIEW

The Installation Restoration Program (IRP) at RMA has been active for over 10 years since the time contamination was found migrating off the installation in ground water. To date, efforts have resulted in a thorough investigation of the contamination problem from a migration standpoint and institution of contamination control oriented remedial actions on the installation. Work is continuing to implement the final remedies for contamination at the Arsenal.

Arsenal Location and Key Physical Features

RMA consists of approximately 27 square miles of land located directly northeast of metropolitan Denver. Land use surrounding the installation is diverse and includes Stapleton International Airport and a light industrial complex and residential areas directly to the south; residential areas to the west and northwest; and agricultural land to the north and east.

In the lower central portion of the installation is located the Chemical Plants Area, which was established in the early 1940's to manufacture chemical warfare materials such as mustard and lewisite. After World War II, the majority of these plant facilities were leased to private commercial entities for the manufacture of pesticide-related products.

In the north-central portion of the installation is the GB Area or North Plants, where the nerve agent GB was originally manufactured and later demilitarized.

Liquid waste effluents from these two manufacturing complexes

were routinely discharged in the 1940s and early 1950s to a series of unlined waste evaporation ponds labeled Basins A, C, D, and E, in the center of the installation.

In the mid-1950s all liquid wastes were transferred to a newly constructed asphalt-lined waste basin known as Basin F. The new basin covered approximately 93 acres and had a liquid capacity of over 240 million gallons. Twelve inches of sand were placed on top of a 3/8-inch thick asphalt liner as a buffer between the waste and liner.

Solid wastes have been routinely disposed in trenches and pits located adjacent to Basin A and the Plants areas.

A series of manmade lakes in the southern portion of the installation were established to provide process and cooling water to facilities within the Chemical Plants Area. These lakes have been contaminated with various process wastes.

Contamination History

Contamination was first evidenced at RMA in the mid-1950s when minor crop damage was found on land north of the Arsenal. The discovery of this material in ground water prompted construction of Basin F in 1956. During the mid-1960s Basin F was augmented by the construction and operation of a 12,000-foot deep disposal well directly adjacent to the basin. This well was shut down after a series of earth tremors in the Denver area. Contamination was again discovered in the mid-1970s with the identification of two organic compounds, Diisopropylmethylphosphonate (DIMP) and Dicyclopentadiene (DCPD), off the installation. DIMP is an Army compound which is a byproduct from manufacture of the nerve agent GB (or Sarin). DCPD is a raw material that was used by Shell Chemical Company for the production of pesticides in the South Plants Area of the Arsenal. The discovery of off-post contamination prompted the issuance of three administrative orders by the Colorado Department of Health (CDH) in 1975 to the Army and Shell Chemical Company to cease and desist contamination.

Installation Restoration Program Summary

Recognition of a need for contamination control at RMA prompted the establishment of a major program within the Army entitled Installation Restoration (IR). This program has as its objectives the elimination of contaminant migration across installation boundaries and the remediation of contaminant sources. At RMA the IR Program was established to meet these goals. As carried out at RMA, the IR program consists of five primary elements.

- . Identification of contaminants

- . Identification of the sources of those contaminants
- . Definition, development, and demonstration of remedial action technology
- . Implementation of interim action whenever necessary to protect human health and safety
- . Implementation of final actions

Contamination Overview

Four principal media have been investigated as possible migration pathways off the installation: air, biota, ground water, and surface water. Field studies found that air pollution is a minor concern limited to the on-post environment from a particulate and odor standpoint. Action is being taken to prevent any hazard to the on-post working staff. Biota is a concern from a migratory wildlife standpoint because of possible movement of contaminated water fowl on and off the installation.

Efforts have been made to minimize the risk to migratory wildlife by placing noise-producing devices in the vicinity of known contaminated areas of the Arsenal, such as Basin F. These also reduce the possibility of any Arsenal contamination being transported off-post by migratory animals. Surface water is being examined to determine if intermittent storm events could carry surface contamination beyond the north boundary of the installation.

However, the most serious concern is the contamination of surrounding ground water. This contamination results from leaching of contaminants from sources into the near-surface ground water. This water then moves off the installation and becomes available for off-post use.

Ground water beneath RMA flows from the southeast to the northwest reaching the South Platte River several miles north of RMA. The two uppermost geologic formations, the alluvial aquifer (thickness 10 to 130 feet) and the Denver formation, have been affected by RMA activities. Ground water travels through the alluvial aquifer and also through sand channels located in the upper portion of the Denver formation.

Over 1,500 wells have been placed on the installation for ground water monitoring. Screening analysis has been performed for over 300 possible compounds. The monitoring data are being used to determine or confirm contamination that poses an environmental concern.

Source Control Study

Available problem definition information was used to conduct an alternatives assessment for selection of a contamination control

strategy for RMA. The stated objective of the contamination control strategy selection study, referred to as the Source Control Study, was to determine the optimum control strategy for ensuring RMA's compliance with applicable and relevant state and Federal environmental regulations. Because of the vast size and complexity of the numerous contamination sources, the program was developed in a logical phased approach. A multidisciplinary study team assembled all of the available data and identified the range of feasible control alternatives. An identification of potential data gaps was completed, along with actions to resolve data gaps, allowing execution of a detailed evaluation of the alternatives. The resulting recommendations for a migration control strategy were placed in a final report entitled "Selection of a Contamination Control Strategy for RMA."

To facilitate implementation of the IRP at RMA, a Memorandum of Agreement (MOA) was established in December 1982 between Colorado Department of Health (CDH), EPA, Shell Chemical Company, and the Army. In addition to monitoring the ongoing survey phases of the IRP, the MOA allows for the cooperative development of a comprehensive remedy for environmental contamination at RMA.

Remedial actions developed from the Source Control Study follow.

- . The first actions deal with below-ground containment barriers placed across the three contaminated ground water pathways leading off the installation. The systems consist of dewatering wells to extract contaminated ground water from the aquifer; carbon adsorbers to remove organic contaminants from the ground water; and recharge wells to place treated water back into the aquifer to resume flow off the installation. These treatment systems are referred to as the North Boundary, Northwest Boundary, and Irondale systems and have been in full-scale operation since November 1981, October 1984, and December 1981, respectively.
- . The first phase in closure of Basin F will involve the elimination of residual liquid from the basin. At the time of the initial study, Basin F contained approximately 170 million gallons of contaminated waste liquid. An evaporation system has been installed and operated to reduce the water content from this liquid waste in order to speed the drying of the waste liquid. Current estimates of the liquid contents place the volume at approximately 20 to 30 million gallons.
- . Two separate sewer systems are in place at RMA. The first is a contaminated sewer system which linked the manufacturing complex with the waste disposal basins. This system has been removed. The second sewer system transports sanitary type wastes from various

manufacturing and office buildings to a central treatment facility located adjacent to the north boundary. This system has been found to be in a state of disrepair requiring its removal in many locations and upgrade in still active locations.

- . The dry portions of Basin A contain high levels of metals and pesticides in the near-surface soils. During the windy, dry months of March and April, wind-blown dust becomes a problem. Periodic surface application of a synthetic dust palliative is being accomplished to reduce the potential exposure of Arsenal workers to contaminated dust.
- . The lower lake sediments have been found to contain high levels of pesticides and heavy metals. The required removal is being designed and coordinated with EPA and the State of Colorado.
- . The 12,000-foot deep disposal well will be plugged, as it presents a possible contamination pathway between the near-surface contaminated aquifers and deep potable aquifers. A contract was awarded in FY85 to plug this well.
- . The last proposed actions are awaiting further scoping as a result of the recent strategy proposal by the Army. The Rail Classification Yard has been found to be a source of the pesticide Nemagon. Following collection of data and a contamination assessment, appropriate alternatives will be developed and evaluated. This area may require excavation and contained storage of the contaminated material. Basin F must be closed in accordance with the Resource Conservation and Recovery Act (RCRA). As indicated earlier, the South Plants area is a contamination source and will require the establishment of water management activities to control further release of contamination to the aquifer. The cost estimate in 1982 dollars to construct and operate the control actions just delineated was estimated at approximately \$131 million over a 30-year time period.

Arsenal Decontamination Study

In conjunction with the Source Control Study, an Arsenal Decontamination Study was performed. The objective was to prepare a planning document for Department of Army use assessing the feasibility and cost of decontaminating all, or portions of, land and facilities comprising RMA, assuming unrestricted use of the land area. Restrictions on water use would continue until contamination has been reduced to acceptable levels for potential use. This effort provided further supporting data on disposal

cost contained in the Source Control Report. It also allowed response to continued requests of the Army to prepare decontamination costs for alternative land use at RMA. Lastly, it fulfilled part of the MOA.

The Arsenal Decontamination Study first screened potential contamination sites determining likelihood for cleanup through the use of literature and limited field data. Volume estimates were then defined by examining, in the case of soils, lateral extent from overhead photographs and the establishment of approximate depths of contamination based upon historical records. Equipment volumes were developed based upon design drawings. Building volumes were estimated through the use of construction layouts. Decontamination costs were developed at a unit cost level.

Categories of material requiring decontamination include migratory toxic and hazardous materials examined in the Source Control Study, unexploded military ordnance and various chemical agent-contaminated buildings and equipment.

The degree of decontamination utilized in this investigation is based on a modified form of unrestricted land use, which required all surface land to be decontaminated to the level where it could be used freely and without restriction. However, temporary restriction would be placed on the use of near-surface ground water until such time as the aquifer naturally restores itself with the aid of the in-ground containment and treatment systems.

The study examined four options:

- Option 1 Limited treatment of contaminated media by applicable technology with disposal of treated, untreated contaminated material and uncontaminated materials in a permitted hazardous waste facility on the installation.
- Option 2 Partial cleanup of RMA wherein four of the center sections would remain in place with other materials from the installation placed within these sections.
- Option 3 Treatment of materials would be similar to Option 1, with disposal in an out-of-state permitted hazardous waste facility.
- Option 4 Treatment of materials would be similar to Option 1, with disposal in a permitted facility within Colorado.

Proposed Remedial Action Strategy

Both the Source Control Strategy Report and the Arsenal Decontamination Report were provided to EPA and CDH for their review and comment through the MOA. Based on their comments, it became apparent that further remedial actions are required if RMA

is to be brought into compliance with applicable and relevant environmental laws and regulations. A series of discussions between the Army and EPA resulted in the October 1984 announcement of a proposal for a more comprehensive remedial action strategy.

As proposed, this strategy would continue control strategy actions that have been constructed or planned for containment of contamination on the installation. The proposed strategy would involve cleanup of all buildings and near-surface soils, estimated to consist of 16 million cubic yards in approximately 88 sites at the installation. Based on data collected to date, the cleanup goal for RMA can be achieved in a timely manner through the excavation and removal of these materials. Some material may be treated prior to disposal. All contaminated and treated material would be placed in a containment facility(s) approximately 1 to 2 square miles. The facility(s) would be constructed in compliance with applicable and relevant environmental regulations (See Appendix C) and would consist of state-of-the-art above-ground vault technology to prevent future contaminant release to the environment. Temporary ground water restrictions would be required while the contaminants in the ground water were allowed to flow to ground water containment treatment systems where they would be treated and discharged for continued flow off the installation.

Execution of the remedial action strategy would occur in five phases as shown in Fig. 1. Phase I is ongoing and would continue until approximately 1990. Quantitative studies of the actual sources will be completed, engineering design will be initiated on landfill and treatment components, and regulatory coordination will be continued. Phase II, which would begin decontamination, is estimated to start in 1990 and continue for approximately 6 years. Construction of various treatment and landfill facilities would occur, and cleanup of the waste basins in sections 26 and 36 would be conducted. Phase III, entailing additional landfill construction and building demolition, would take the next 2 years to execute. Phase IV would complete the actual cleanup by the demolition of the manufacturing and industrial complexes at the South Plants Area and the GB plant. Phase V would begin in 2000 and proceed as required for continuation of monitoring and control systems.

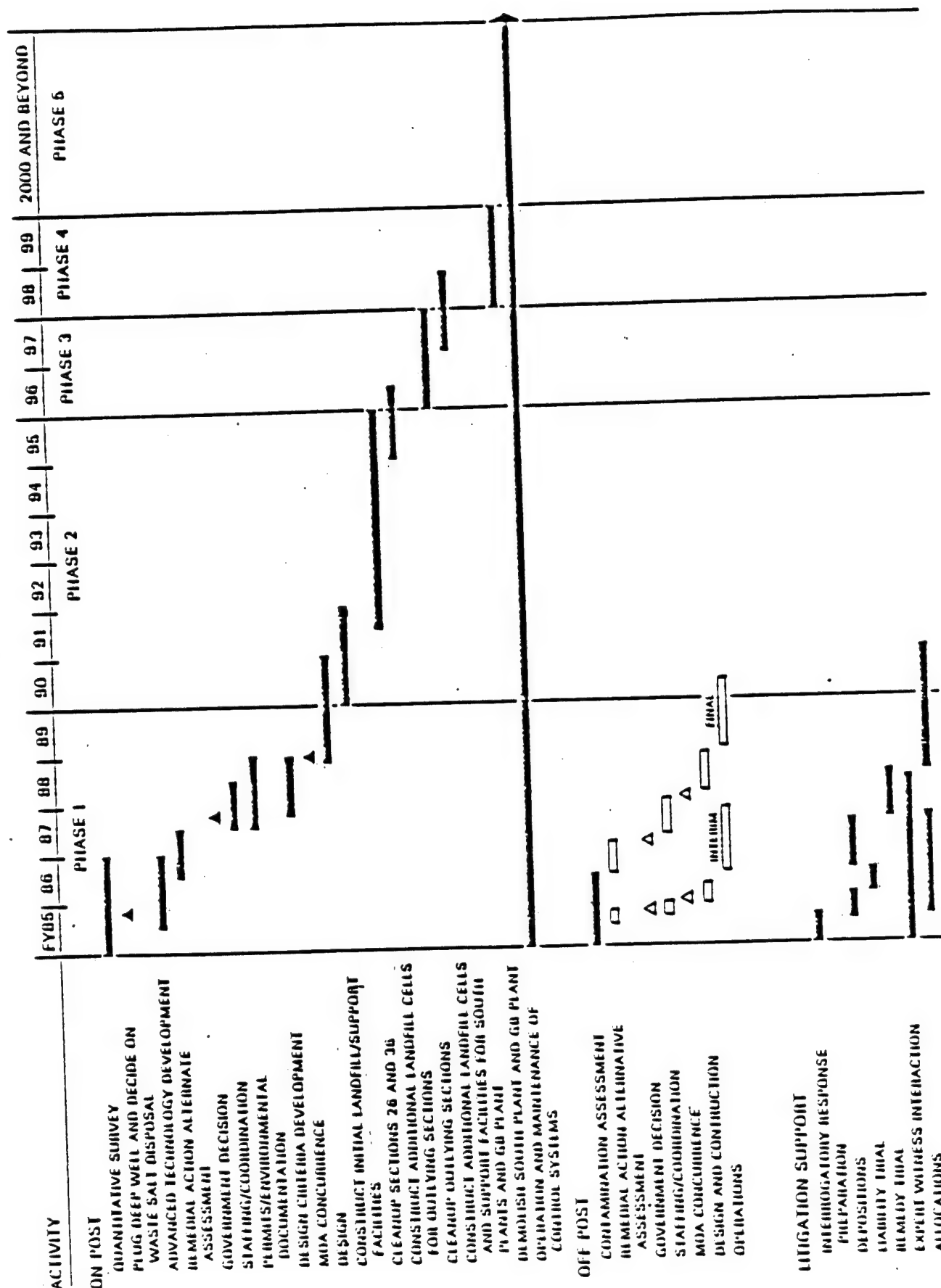
PHASE I TECHNICAL PROGRAM PLAN

The following Phase I efforts must occur between now and the time of actual cleanup:

- . This proposal was released to the regulators and public on October 22, 1985. The Army has received comments on the proposal from CDH, EPA, Shell Chemical Company, the Mayor of Denver, and the surrounding municipalities of Adams County, Brighton, and Commerce

RMA INSTALLATION RESTORATION PROGRAM SCHEDULE

FIG. 1.



City.

- . An assessment of the 4 lower square miles of RMA was conducted to determine the extent of contamination for an environmental impact statement which the Federal Aviation Authority is preparing for expansion of Stapleton Airport.
- . Advanced technology found to be technically and economically advantageous will be used to expedite the remedial action program whenever possible. Lead time for this effort is extensive and therefore must be started as soon as practical. For example, in situ microbial degradation may not be implemented during cleanup even if this technology is advantageous, because the time to fully develop the technology precludes accomplishing cleanup through this technology with allotted time frame.
- . Current ongoing actions include:
 - disposal of waste salts
 - plugging of the deep well
 - reevaluation of closure of Basin F
 - investigation of advanced technologies
 - continuation of ongoing contamination surveys on and off the installation
 - continuation of coordination with regulators
- . With the input from these actions, a decision on the final remedial action strategy is expected to be completed in March 1987. Submission to the MOA parties and the public is expected in October 1987.
- . It is expected that all necessary permits, environmental documentation, and development of supporting design criteria will be completed in the summer of 1988.
- . Design can be initiated in October 1988, allowing initiation of decontamination activities in 1990 as scheduled.
- . All ongoing environmental monitoring and control system operations will be continued throughout and beyond the period to ensure that the on-post and off-post public are not adversely affected.

To facilitate the development of a Phase I Technical Program Plan to decontaminate lands and facilities at RMA, the necessary work has been divided into various tasks. The tasks in turn have been organized or grouped into the following seven elements:

Remedial Investigations

Endangerment Assessment
Feasibility Study
Design and Execution
Operation and Maintenance
Program Management
Program Support

The Remedial Investigations, Endangerment Assessment, and Feasibility Study are required elements of the National Contingency Plan (NCP) and must be accomplished before actual cleanup can begin.

The purpose of the Remedial Investigations (RI) is to determine the nature and extent of the contamination and gather all necessary data to support the Feasibility Study. At RMA, much of the work that would normally be accomplished in the RI has been completed. Thus, the RI tasks described in this report are work that is either ongoing or is required.

The Endangerment Assessment, a component of the Remedial Investigations/Feasibility Study, is used to determine the magnitude and probability of actual and potential harm to the public health or environment from the release of pollutants from a site. It is based largely on information collected in the RI and the analyses conducted in the FS.

The purpose of the Feasibility Study (FS) is to develop and evaluate remedial alternatives for cleaning up the contamination at RMA. The cleanup will include the removal, treatment and restoration of the land that is disturbed during the cleanup. In the evaluation of alternatives, both existing equipment and technologies will be examined as well as advanced technologies that could make the cleanup more efficient and less costly. Demonstration pilot studies are included in feasibility study tasks to evaluate the applicability of existing technologies, the feasibility of using advanced technology, and the development of design criteria. The remedial technologies will be selected following completion of the feasibility study.

The Design and Execution (construction and or cleanup) element includes development of design criteria including supportive pilot studies on selected technologies, final design of remedial facilities, control actions addressing source areas and migration pathways (in order to protect the health of the public and/or to satisfy regulatory compliance), and off-post remedial actions. On-post activities will include:

- A. Plugging deep well,
- B. N and NW boundary system alterations,
- C. Waste salts disposal and facility closure,
- D. Fugitive dust control,
- E. Basin F closure,
- F. Lower lakes sediment removal,

- G. Upgrade sanitary sewer, and
- H. Hydrazine facility closure.

Off-post operations may include water treatment and distribution systems to provide water to off-site houses.

The Operation and Maintenance element includes the continuation and completion of work to operate and maintain the existing control system and to eliminate potential sources of contamination. This report focuses on Phase I and thus only shows that most of the tasks will continue up to the end of FY 1989; it is understood that some of the tasks will continue after FY 1989 until they are no longer required.

The Program Management element includes the Program Manager's (PM's) office and the immediate technical management staff needed to support the PM. Staff elements include engineering, operations/monitoring, and coordination.

Program Support includes a variety of activities that must be available to support the operational tasks, including permitting, legal support, community relations, data management, systems analysis, analytical support, quality control, and health and safety.

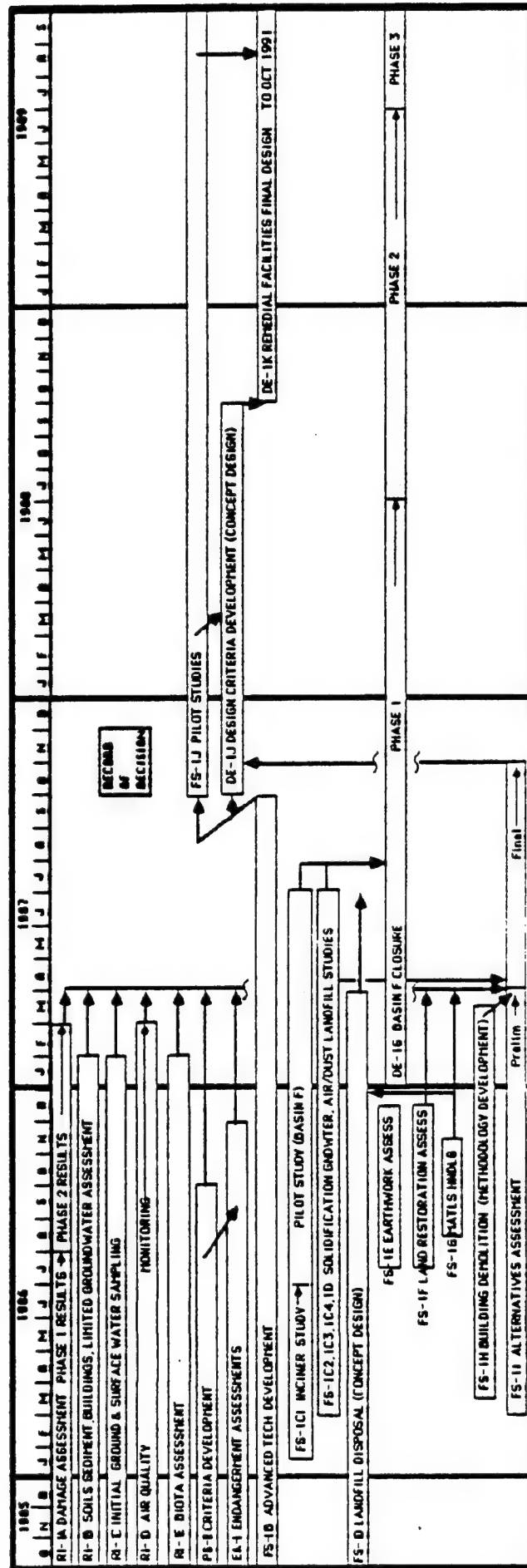
Schedule

Appendix A illustrates the Phase I schedule for Remedial Investigations, Endangerment Assessment, Feasibility Studies, Design & Execution, and Operations and Maintenance. Also illustrated are key relationships among the various tasks: for example, the results of Task FS-1B (Advanced Technology Development) and DE-1J (Design Criteria Development). The results of these two tasks are needed input to Task DE-1K (Remedial Facilities Final Design). Although the chart begins in October 1, 1985, some tasks were initiated prior to that time.

The schedule is controlled by three milestones: (1) Remedial Action Strategy Decision, March 1987; (2) Initiation of Construction, October 1989; and (3) Initiation of Full-Scale Decontamination (Phase 2), October 1990.

Task Descriptions

Appendix B contains summary task descriptions, organized by planning element. The task descriptions provide a brief synopsis of the objective and key aspects of each task. These synopses are concise reference sources of information for overseers and



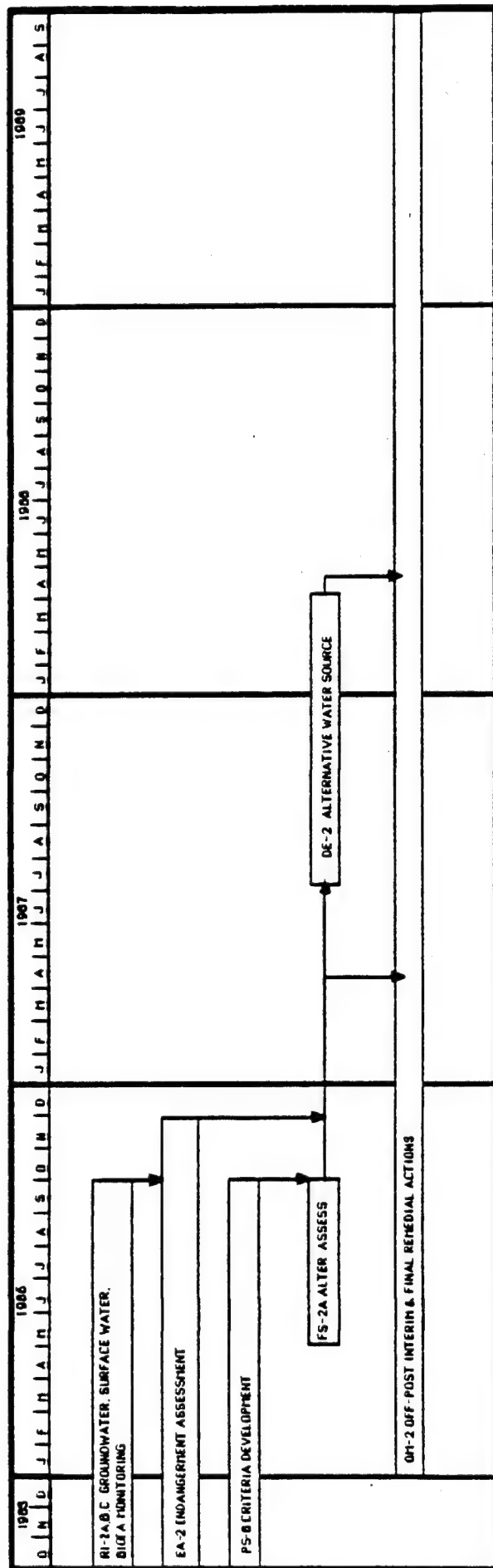
Phase I Schedule ON-POST Sheet 1

Rocky Mountain Arsenal

1985	1986	1987	1988	1989
J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
DE-1B PLUG DEEP WELL				
DE-11.B ALTERATIONS TO N AND NW BOUNDARY SYSTEMS				
DE-1E WASTE SALTS DISPOSAL				
DE-1F FUGITIVE DUST CONTROL				
DE-18 LOWER LAKES SEDIMENT REMOVAL				
DE-11 UPGRADE SANITARY SEWER				
DM-1A1,1A2 NORTH AND NORTHWEST BOUNDARY SYSTEMS OPERATIONS				
DM-11.3 BASIN F EVAPORATION				
DM-16.4 LABORATORY WASTE TANK TREATMENT				
DM-1B1 BOUNDARY SYSTEMS MONITORING & SYSTEM EVAL				
DM-1B2,1B3 GROUND WATER AND ECOLOGY MONITORING				
DM-1B4 AIR MONITORING				
DM-1B5 FUGITIVE DUST MONITORING				

Phase I Schedule ON-POST (Sheet 2)

Rocky Mountain Arsenal



Phase 1 Schedule OFF-POST

Rocky Mountain Arsenal

planners of the program. They include task title, program identification number, performance time frame, estimated required resources, objective, description, and remarks. Appendix C comments from CDH, EPA, and Shell Chemical on the draft descriptions for these tasks and the responses to these comments from the PMO.

APPENDIX B
TASK DESCRIPTIONS

REMEDIAL INVESTIGATIONS

TITLE	On-Post - Damage Assessment Reports
NUMBER	RI-1A
TIME FRAME	START Ongoing END 28 Feb 87
MAN-YEARS	Included as part of all RI tasks.
OBJECTIVE	Collect, review, and incorporate the results of all studies and investigations pertinent to the Remedial Investigations (RI) in a report oriented to specific geographical areas.
DESCRIPTION	The purpose of the Damage Assessment Report is to: <ul style="list-style-type: none"> o Present the existing damage assessment data in a manner that allows ready access to reference material on which the assessment is based. o Provide existing information regarding baseline conditions and the extent of contamination at individual disposal sites. o Provide information concerning data deficiencies for site-specific areas on RMA, so that these data gaps may be corrected in the scheduled field program. o Provide information on the historical relationship among manufacturing, industrial waste disposal by RMA and lessee operations for designing remediation.
REMARKS	These reports were initiated in 1984 as part of the litigation effort, and are working documents to be continually updated throughout the RI effort.

ROCKY MOUNTAIN ARSENAL TASK DESCRIPTIONS

TITLE	On-Post - Soils, Sediment, Buildings, and (Limited) Ground Water Assessment	
NUMBER	RI-1B	
TIME FRAME	START Ongoing	END 31 Jan 87
MAN-YEARS	125	
OBJECTIVE	To quantitatively define the lateral and vertical extent of contamination in soils and sediment Arsenal-wide; to determine the relative degree of contamination in all Arsenal buildings and structures; to collect information on ground water contamination in select areas of RMA.	
DESCRIPTION	<p>The purpose of this program is to develop the information necessary to define a feasible remedial action strategy for RMA. The program utilizes a two-phase approach to first determine types of contaminants present at a site by wide range screen-type analyses, and then quantitatively define source geometry. An estimate of the extent of contamination in buildings, sewers, sumps, tanks, and other structures is concurrently determined. Wells will be constructed in areas where little current information exists on ground water conditions, for inclusion in the comprehensive ground water assessment being conducted in Task RI-1C. The following information will result from this program:</p> <ul style="list-style-type: none"> o Identify industrial chemicals, explosives, and other toxic and hazardous materials present. o Determine quantitative concentrations of the above contaminants. o Determine areal and vertical extent of contamination sources. o Identify the cause and origin of contamination. o Evaluate statistical confidence for assessment of type and extent of contamination. o Formulate a detailed description of local subsurface geology/stratigraphy. o Refine existing ground water contour maps with additional data. o Refine rate of ground water flow with additional data. o Refine aquifer characteristics. o Examine chemical specification of contaminants 	

and how contaminant properties relate to
contaminant migration.

- o Determine contamination migration rates from
sources.

REMARKS

Phase I work was started in Oct 1984 and should be
completed by Jul 86. Phase II work will begin in
Feb 86 and is to be completed by Jan 87.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Initial Ground and Surface Water Monitoring
NUMBER	RI-1C
TIME FRAME	START 1 Jun 85 End 31 Jan 87
MAN-YEARS	20
OBJECTIVE	To sample and analyze ground water and surface water samples Arsenal wide; to conduct a water balance and seasonal water table determination.
DESCRIPTION	The purpose of this program is to provide a litigation-quality core data base for ground and surface water quality and quantity data throughout RMA. This program augments historic monitoring programs by selecting key wells and surface water sites for sampling and quantitative chemical analysis. The initial one year program consists of four quarterly (seasonal) sampling and analysis efforts, incorporating RMA's 360-Degree Monitoring Program. Protocol and methods will be of litigation quality, following stringent QA/QC and chain-of-custody procedures. The program includes a water balance for surface waters throughout the Arsenal, including the installation and monitoring of gaging stations and collection and analysis of quarterly surface water samples by litigation-quality methods.
REMARKS	This program provides a core data base which will allow initiation of indefinite monitoring of the Arsenal. Through this monitoring, compliance with regulatory mandates (e.g., cease and desist orders) associated with ground and surface water monitoring is satisfied. The resource utilization is consistent with the analytical and quality assurance requirements. After the first year, the remainder of this program will be covered under Operation and Maintenance.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE	On-Post - Air Quality
NUMBER	RI-1D
TIME FRAME	START 1 Oct 85 END 28 Feb 87
MAN-YEARS	5
OBJECTIVE	To establish an air monitoring program with associated monitoring network.
DESCRIPTION	The purpose of this program is to establish an air quality baseline prior to cleanup activities at the Arsenal. This program will be an extension of past monitoring networks established on the Arsenal and will continue as O & M program throughout cleanup activities. Baseline conditions are necessary to determine air quality impact of Arsenal operations as opposed to off-post impacts from local industrial or EPA Superfund sites. The network will consist of instrumentation to collect, measure, and/or record ambient levels of particulates, vapors, and specific contaminants, along with standard climatic parameters.
REMARKS	This task will be coordinated with task RI-1A to review previously collected information. This task will also be coordinated with the permitting requirements (Task Number PS-1). After the first year, this task continues as an O & M program.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Biota Assessment
NUMBER	RI-1E
TIME FRAME	START 1 Jul 85 END 31 Jan 87
MAN-YEARS	5
OBJECTIVE	To conduct a contamination assessment of the wildlife and flora of Rocky Mountain Arsenal and the surrounding environment.
DESCRIPTION	The purpose of this program is to determine the impact of past and current Arsenal contamination, and to establish a baseline on which to measure impact of future cleanup activities on the flora, wildlife, and habitat on and surrounding RMA. The program will be conducted in two phases. The first phase incorporates literature review, past biota studies, and current off post studies to assess current biota conditions and identify data gaps. Phase II includes a field sampling and analysis program and population studies to fill identified data gaps, estimates the impact of future cleanup activities on local biota, and prepares SOP's and contingency plans for alleviating disruption of the ecosystem during cleanup, to the maximum extent practical.
REMARKS	Coordination is required with Tasks RI-1A and RI-2C. The task will be continued as a monitoring program throughout the O & M phase.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE Off-Post - Ground Water Monitoring

NUMBER RI-2A

TIME FRAME START Ongoing END 30 Sep 86

MAN-YEARS 15

OBJECTIVE Provide overall picture of ground water levels and quality in areas north and northwest of RMA.

DESCRIPTION Ground water quality will be determined by sampling 120 existing wells in areas north and northwest of RMA. The 120 wells to be sampled include:

- o 37 wells from off-post 360' monitoring program (previously sampled)
 - 27 Alluvial wells (< 100')
 - 4 Denver wells (100' - 350')
 - 6 Deep wells (>350')
- o Private wells (not previously sampled)
 - 62 Alluvial wells
 - 11 Denver wells
 - 10 Deep wells

Information from the well sampling program will be used to determine areas where Arsenal-related contamination could present potential health risks to the off-post public and to identify areas where ground water quality information is not obtainable.

In general, water level and lithologic control in the off-post area is very limited and additional data points are necessary. Twenty-nine new monitoring wells have been installed to supplement ground water quality information and water table control in area off-post of RMA.

REMARKS New wells are currently scheduled to be sampled for 2 quarters (1st and 2nd Quarter FY86); however, two more quarters of sampling will be added to supply additional water quality information.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Off-Post - Surface Water and Sediment Monitoring		
NUMBER	RI-2B		
TIME FRAME	START	Ongoing	END 30 Sep 86
MAN-YEARS	2		
OBJECTIVE	Determine whether surface water carries or has carried Arsenal contamination into off-post areas.		
DESCRIPTION	Surface water and sediment will be monitored at 11 sites off-post to determine whether Arsenal related contamination is present. Should Arsenal contamination be present in surface water samples, other pathways to humans (related to surface water), such as fish and crops irrigated with canal water, will be investigated.		
REMARKS	Samples are currently scheduled to be taken during the 1st and 2nd Quarter FY86; however, two more quarters of sampling may be added to supplement those data.		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE Off-Post - Biota Monitoring

NUMBER RI-2C

TIME FRAME START Ongoing END 30 Sep 86

MAN-YEARS 2

OBJECTIVE To determine whether wildlife may represent a significant pathway for Arsenal related contamination to reach the off-post public. This task will be conducted in two phases.

DESCRIPTION Phase I of this task will be prioritized to include collection of population and migration data for Cottontail Rabbits and Ringneck Pheasants to determine the magnitude of these species migrating off the Arsenal. These species were selected for the study because they are the animals most likely to be hunted and consumed by the off-post public and have a high likelihood of biological uptake. Techniques to be used are tag/recapture and telemetry.

 Phase II studies (i.e. tissue analysis) will be conducted should the data collected indicate that these species represent a significant pathway to off-post population. Studies in this phase may include ducks if they are determined to be a pathway of Arsenal related contamination migration.

REMARKS Coordination is required with Tasks RI-1A and RI-1E.

ENDANGERMENT ASSESSMENT

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Endangerment Assessment
NUMBER	EA-1
TIME FRAME	START 1 Jun 85 END 30 Nov 86
MAN-YEARS	6
OBJECTIVE	Determine the magnitude and probability of actual and potential damage to humans and the environment from contaminants released from RMA.
DESCRIPTION	<p>The endangerment assessment must identify and characterize:</p> <ul style="list-style-type: none">o Chemicals or mixtures present in all relevant environmental media.o Environmental fate and transport mechanisms within specified environmental media, including hydrogeological evaluations and assessments.o Toxicological properties of specified substances.o Exposure pathways and extent of expected exposure.o Populations at risk.o Extent of expected harm and the likelihood of such harm occurring. <p>Tasks for biota and demographic studies will be performed within the RI phase in support of the endangerment assessment.</p> <p>The demographic survey will be a paper study using existing records such as census records and zoning maps in order to obtain estimates and profiles of the population actually or potentially at risk from RMA contaminants.</p>
REMARKS	<p>The assessment is a required action within the National Contingency Plan and is used to justify remedial actions. This effort will be performed in phases.</p>

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE	Off-Post - Endangerment Assessment
NUMBER	EA-2
TIME FRAME	START 1 Jun 85 END 30 Nov 86
MAN-YEARS	2
OBJECTIVE	Determine the magnitude and probability of actual and potential damage to humans and the environment from pollutants released from RMA.
DESCRIPTION	The description of this is essentially the same as that provided for On-Post Endangerment Assessment. The main difference is that the on-post assessment will be dealing with the unrestricted use of land and potential contact with surface contamination, whereas the off-post assessment will address ground water and its use as a drinking source.
REMARKS	The assessment is used to justify remedial actions. This effort may be performed in phases.

FEASIBILITY STUDY

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Summary of Previous Investigations
NUMBER	FS-1A
TIME FRAME	START 1 Mar 86 END 30 Jul 86
MAN-YEARS	2
OBJECTIVE	Collect and collate the results of all studies and investigations pertinent to the Feasibility Study (FS).
DESCRIPTION	<p>Gather all necessary data to support the tasks to be carried out under the feasibility studies. The available information must be reviewed and referenced for the efficient use by the Department of Justice expert consultants and personnel working on other FS tasks.</p> <p>Previous efforts to be summarized include:</p> <ul style="list-style-type: none">o Ground water treatment studies using boundary, Basin F vicinity, and South Plants source waters.o Ground water containment barrier evaluations.o Basin F treatment, solidification and disposal studies.o Landfill site selection and design efforts.o Compatibility studies. <p>Review of information will result in recommendation of whether studies investigated are applicable to the present approach for cleanup of the Arsenal. Evaluation will also identify those areas where potential remedial technologies have not been previously evaluated. Task deliverable will also recommend tasks needed to fill any data gaps identified.</p>
REMARKS	None.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Advanced Technology Development
NUMBER	FS-1B
TIME FRAME	START 1 Jul 85 END INITIAL 30 Sep 87 LONG TERM Continuing
MAN-YEARS	10 (Initial Approximately 5 Man Years/Year Thereafter)
OBJECTIVE	To identify and investigate new and innovative waste treatment technologies for potential use in lieu of incineration and landfilling.
DESCRIPTION	<p>This task shall start with an examination of state- of-the-art technology. Subsequently, selected novel procedures shall be identified and developed to the bench scale.</p> <p>Testing shall be conducted to determine the feasibility of each of the more promising processes. The conditions under which each of these approaches would be most applicable shall be identified. Technical and cost considerations will be used to determine if pilot scale demonstration tests are appropriate.</p> <p>This advanced technology development will run concurrently with feasibility studies on the more conventional incineration/landfill approach to decontamination. At the end of FY 87, a decision will be made as to which process(es) will advance to design criteria development DE-1J.</p>
REMARKS	R & D efforts will take place throughout Phase I to continually keep abreast of novel and emerging technologies for land and facility decontamination. Following initial efforts which end upon technology selection, additional technology development may be conducted for those sites or contaminants for which available technologies are not suitable.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Incineration

NUMBER FS-1C1

TIME FRAME START 15 Jan 86 END 30 Jun 87

MAN-YEARS 40

OBJECTIVE Identify steps necessary for full-scale implementation of incineration. Conduct laboratory and preliminary pilot-scale incineration test in order to determine operating parameters and requirements for full-scale incineration of suitable RMA wastes.

DESCRIPTION Task activities shall include:

- o Selection of an incineration system.
- o Review and selection of technology for feeding wastes to the incinerator.
- o A laboratory study to evaluate performance and determine residence times, temperatures, ash characteristics, and other parameters required to thermally process selected wastes.
- o Determine if thermal processing is technically suitable and cost effective.
- o Logistical preparations.
- o Definition of operating procedures, including safety, training, and decontamination procedures for personnel and equipment.
- o Preparation of an on-site pilot-scale burn plan and accompanying sampling and analysis plan.
- o Submission and processing of permit application packages.
- o Setup and shutdown of the incinerator system.
- o Conduct pilot-scale test.
- o Analyze and report results.

Feedstocks to be examined will consist of Basin F liquid residue/sludges, contaminated soils, surety contaminated building rubble/equipment, and unexploded munitions. Priority shall be given to Basin F treatment for input to FY88/FY89 closure activities at the basin.

REMARKS None.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Solidification

NUMBER FS-1C2

TIME FRAME START 1 Mar 86 END 30 Jun 87

MAN-YEARS 15

OBJECTIVE To verify, by pilot scale testing, the feasibility of solidifying various RMA wastes.

DESCRIPTION Representative wastes will be collected and pilot scale evaluation of several solidification processes will be conducted. Structural and chemical leaching characteristics of solidified and crushed solids will be conducted. Potential long-term effects of land burial of solidified wastes will be evaluated. Task should specifically address any problems associated with solidifying a particular test material (e.g., ammonia off-gassing problem when solidifying Basin F material). Study should also address technical feasibility of determining integrity of a processed batch before it is disposed in a landfill.

 Final product of this task should include:

- o Refinement/validation of performance criteria for solidification processing (e.g., compressive strength, chemical leaching, permeability, etc.) previously developed for a "worst case" material at RMA (Basin F liquid and overburden).
- o Initial design criteria ("concept design") for full scale solidification plant.

REMARKS This effort may be curtailed or eliminated based on early results of the advanced technology and/or incineration tasks.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Ground Water and Process Wastewater Treatment

NUMBER FS-1C3

TIME FRAME START 1 Feb 86 END 30 Jun 87

MAN-YEARS 20

OBJECTIVE Conduct investigations to fill data gaps identified by previous pilot ground water treatment tests at RMA. Develop treatment system from process units including incinerator scrubber water, leachate collected from landfill operations, and washdown water from building decontamination.

DESCRIPTION A pilot ground water treatment plan was operated to treat water representing "worst case" and "most likely case" water qualities in the South Plants area of RMA. Pilot treatment plant included: clarification/softening, packed column air stripping, granular activated carbon adsorption, reverse osmosis, u.v. oxidation, and kiln incineration. Tests resulted in a "concept design" of a full-scale ground water treatment plant for the South Plants area; however, the following information must be collected before the final design can proceed:

- o Water quality of the effluent streams must be defined as much as possible to facilitate water treatment. Water quality will be determined by investigating ground water in the area or by defining leachate parameters of the potential on-post landfill.
- o Water volume and feed rates for treatment must be estimated. If an area is to be dewatered, pumping rates throughout the area will be determined to estimate the amount of water to be treated daily. Volume and pump rates of water to be treated are needed to size treatment equipment.
- o Using results of the first two investigations, a mechanism will be determined to control feed stream to treatment plant (e.g., use of manifold system).
- o Need for incineration should be better defined (i.e., is incineration needed for treating off-gas from packed column stripper, reactivating

- spent carbon from adsorbers, or treating sludge from clarifier/softener?).
- o Method for disposal of sludge from clarifier/softener should be determined.
- o Method for reinjection of treated water (e.g., reinjection wells, leach field, surface discharge, etc.) should be investigated.
- o Methods of disposal of untreated water need to be investigated.

REMARKS

None.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Air/Dust
NUMBER	FS-1C4
TIME FRAME	START 1 Mar 86 END 30 Jun 87
MAN-YEARS	2.0
OBJECTIVE	To determine the types and amounts of potential emissions caused by excavation of soils, building destruction, and water treatment; and evaluate methods to suppress or reduce these emissions.
DESCRIPTION	The purpose of this study is to develop design criteria for various suppression technologies to control fugitive emissions during the cleanup phase. Various fugitive emissions will be generated during field operations. Vapors, gases, and dusts will arise during solidification, wastewater treatment, landfill construction, excavation, transportation or through other advanced technologies. Initial design criteria will be developed under this task for abating air pollution from these operations. Construction emission controls, such as dust suppression, will be evaluated for the construction phase of operations.
REMARKS	This task will be closely coordinated with Task RI-1D, On-Post Air Quality, to obtain necessary ambient air quality data.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Landfill Disposal
NUMBER	FS-1D
TIME FRAME	START 1 Feb 86 END 30 Jun 87
MAN-YEARS	10
OBJECTIVE	Using the landfill concept design previously completed for Basin F Closure Project as a reference, develop a concept and preliminary design for a hazardous waste landfill capable of handling all contaminated waste at RMA.
DESCRIPTION	<p>A concept design for a 600,000 cy landfill for RMA materials has been completed. A similar concept design for a landfill capable of handling all RMA waste must be completed. Preparation of concept design will include:</p> <ul style="list-style-type: none">o Evaluation of alternative waste cell concepts including types of cells (earthen, reinforced concrete, slurry trench), location with respect to ground surface (above grade, below grade, or a combination above-below grade) and types of liners.o Conceptual layout of landfill facility to include number of cells, configuration of cells, and waste hauling and filling operations.o Design should also include estimated construction, closure and post-closure schedules and costs.o Evaluation should also be made of the feasibility of completing a large scale landfill operation in a timely and cost efficient manner.
REMARKS	On-site and off-site landfill disposal option feasibility studies will be included in this task.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Earthwork
NUMBER	FS-1E
TIME FRAME	START 15 Jul 86 END 15 Dec 86
MAN-YEARS	4.0
OBJECTIVE	To find sources of borrow material and determine viable methods of moving the borrow material to where it is needed.
DESCRIPTION	<p>Borrow sources for construction of the clay cap, sand blankets, and subgrade materials are needed. Existing data do not indicate whether sufficient material is available at RMA. Existing borehole data will be reviewed to see if potential sources are available on RMA. If suitable borrow areas do not exist on RMA, outside sources must be located.</p> <p>This assessment will include the quantification and quality testing of the materials and transportation methods to bring the materials to RMA. Consideration will be given to cost in addition to public impact (congestion).</p> <p>Alternatives of truck and rail transport will be evaluated. A materials handling plan will be developed to examine potential transportation methods such as scrappers, trucks, loaders, and conveyors. Materials processing techniques such as size screening and additives (bentonite) to soils for use as liners or drainage zones will also be defined.</p>
REMARKS	None

TITLE	On-Post - Land Restoration		
NUMBER	FS-1F		
TIME FRAME	START	15 Jul 86	END 15 Dec 86
MAN-YEARS	4.0		
OBJECTIVE	To determine how to restore and revegetate the land that is disturbed during cleanup.		
DESCRIPTION	<p>The soil that is removed for treatment or disposal must be replaced. Methods to replace and compact the soil will be determined. Top soil will be stockpiled or means must be found to build up soil with soil amendments to permit the growth of plants. Composted sludge or other sources of organics will be considered as soil amendments. If suitable top soil and soil amendments are not available, top soil from off-post will have to be considered.</p> <p>Revegetation plans will be developed for the temporary seeding of topsoil that can survive in this semi-arid climate. Vegetation for the final cover must be selected to prevent penetration of the liner material. Erosion and sedimentation control plans in addition to appropriate permits will be developed in this task.</p> <p>Wherever possible, actual pilot programs will be conducted under the field conditions to be encountered. The more promising techniques will be tested throughout Phase I.</p>		
REMARKS	None.		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Materials Handling Evaluation
NUMBER	FS-1G
TIME FRAME	START 15 Aug 86 END 15 Nov 86
MAN-YEARS	1.0
OBJECTIVE	To develop methods to remove contaminated materials and transport to treatment or disposal sites.
DESCRIPTION	<p>Preliminary studies have indicated that transport to the on-site landfill or incinerator with haul trucks is preferred. A detailed waste materials handling plan needs to be developed. This plan will optimize equipment usage and recommend the size of equipment to complete the task. Important considerations to be addressed include: how the waste will be placed in the landfill (segregated vs. comingled), equipment weight (for design of haul roads), and trafficability in areas where wet clay may be excavated.</p> <p>Advanced excavation and transportation techniques for some sites will be considered. For example, if the lakes cannot be dewatered, the pesticide contaminated sludge may need to be removed by dredging, suction pumps or other methods. In addition, use of a continuous conveyor system will be investigated.</p> <p>Coordination with the Earthwork task (FS-1E) will be required in development of any removal and transportation plans in addition to replacement of decontaminated (incinerated) soils.</p> <p>Pre-excavation subtasks such as placement of weigh scales, development of decontamination techniques, and health and safety concerns in hauling will be included in this task.</p>
REMARKS	None.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Building Demolition

NUMBER FS-1H

TIME FRAME START 15 Mar 86 END 15 Mar 87

MAN-YEARS 5.0

OBJECTIVE To develop methodology to demolish contaminated buildings.

DESCRIPTION The Remedial Investigation will determine the extent of contamination of buildings at RMA. This task will develop methods to demolish the buildings.

 Methods of in-situ decontamination will first be considered to reduce volume and expense of landfilling all contaminated buildings. Methods include techniques for pipe, wall, and equipment cleaning. Cleaning techniques such as chemical neutralization, solvent and detergent washing, steam cleaning, sandblasting, vacuuming, scrapping, etc. will be evaluated.

 In addition to fugitive dust prevention plans, a health and safety plan will be developed for all aspects of building dismantling and demolition. The demolition plan must consider the potential of incineration for destruction of surety material. Removal and disposition of decontaminated material will also be considered in the building demolition plan.

 Demolition of surety (chemical agent) contaminated buildings/ equipment poses a special and unique problem. Close coordination will be necessary between this task and Advanced Technology Development (Task FS-1B). Currently, no experience is available on large-scale surety decontamination.

REMARKS May have to be extended to 30 Sep 87.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Alternative Assessment

NUMBER FS-1I

TIME FRAME START 1 Mar 86 END 30 Oct 87

MAN-YEARS 20

OBJECTIVE To conduct a remedial action alternatives assessment in order to select the most cost effective and beneficial alternatives for abating contamination at RMA.

DESCRIPTION This task is an essential component of the CERCLA process and will be conducted in accordance with guidance for conducting feasibility studies as established by Subpart F of the National Contingency Plan.

- o The alternatives assessment will be conducted based on site investigation data collected in remedial investigation tasks RI-1A, RI-1B, RI-1C, RI-1E, and in response to remedial action response objectives determined by the Endangerment Assessment (EA-1) and the Criteria Development (PS-8).
- o Inputs to the alternatives analysis necessary in selecting and evaluating alternatives include results, recommendations, and design criteria established in the following feasibility study tasks: FS-1B, FS-1C, FS-1C2, FS-1C3, FS-1C4, FS-1D, FS-1E, FS-1F, FS-1G, and FS-1H.
- o The analysis must be complete, thorough, and all conclusions and recommendations must be justified. A complete description of the remedial action alternatives shall be given. If any alternative is found to be unacceptable early in the analysis based on initial screening of alternatives using criteria of:
 - (1) cost,
 - (2) effects, and
 - (3) acceptable engineering practicesuch that the alternative does not warrant a complete analysis, then the justification for not considering that alternative further in the

analysis should be provided.

The analysis of each alternative shall include all costs, technical feasibility, effectiveness in mitigating the contamination, adverse effects, regulatory requirements and schedule associated with each alternative.

Included in the alternatives analysis will be an inflation analysis to show the effects of schedule on costs.

Conclusions and recommendations on the prepared remedial alternative shall be made resulting in a Record of Decision (ROD).

REMARKS

Results of this task are used in establishing remedial actions to implement the cleanup strategy. The ROD will be submitted to EPA and CDH for their concurrence and approval, and presented to the public for their review, comment, and acceptance.

The results of this task provide input to the design criteria development in terms of establishing type of technology, system sizing, and throughput.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post Pilot Studies

NUMBER FS-1J

TIME FRAME START 1 Oct 87 END 30 Sep 89

MAN-YEARS 11.0

OBJECTIVE Conduct pilot operations to:

a. Generate design criteria for final strategy components.

b. Begin actual cleanup activities using existing or modified equipment or mobile incinerators at the more contaminated sites.

DESCRIPTION The Alternatives Assessment (Task FS-1I) will result in a definitive set of remedial actions for implementation. Many of the initial design criteria for these elements will have been developed during the technology development feasibility studies conducted in 1986. However, experience at RMA has shown that additional design criteria will have to be developed as part of field scale pilot operations prior to any conceptual design efforts.

This task will implement a series of field activities testing to address elements such as:

o Landfill components (liners/covers)

o Incineration (residence times, pollution abatement, material handling)

o Site reclamation

o Transportation

o Logistics

It is anticipated that actual test plots be established using several conventional technologies. Source materials from sites such as Basin F and Basin A are possible feedstocks to feasible excavation/transportation/treatment/landfill techniques. During the latter task years, actual treatment processes, decontamination facilities and containment vessels may be implemented as demonstration units to assist in permit evaluation and approval by the regulators.

REMARKS The laboratory phase consists of basic applications

testing to determine the applicability of the technology. For example, to determine if activated carbon treatment was appropriate for treatment of contaminated water at the RMA boundary, laboratory isotherms were run to determine if carbon in an equilibrium test could remove the specific contaminants to desired treated effluent concentrations.

The bench-scale phase further confirms technology applicability and develops parameters and criteria for conducting field studies. The size of the bench equipment is sufficient to be representative of the system to be used in subsequent field studies or in full-scale application. In the evaluation of activated carbon treatment at RMA, two-inch diameter columns packed with carbon were used to determine carbon performance in a dynamic application, and to establish pilot testing criteria such as system contact time.

The field testing phase is conducted using systems of either full-scale or prototype size that are representative of full-scale design, operations, and materials of construction. Typically, actual contaminated materials are used and the tests are conducted on the site. In the field carbon testing at RMA, full-scale sized adsorbers were leased from Calgon and tests were conducted on-site using actual contaminated ground water. The results of these field tests resulted in selection and final design of the carbon system.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE Off-Post - Alternative Assessment

NUMBER FS-2A

TIME FRAME START 1 Mar 86 END 30 Sep 86

MAN-YEARS 3

OBJECTIVE To conduct a remedial action alternatives assessment in order to select the most cost effective and beneficial alternatives for abating off-post contamination.

DESCRIPTION This task will assess all reasonable solutions to control the release of contaminants from RMA and to develop solutions to provide safe potable water for off-post residents affected by Arsenal contamination.

The alternatives assessment will be conducted based on the site investigation data collected in Remedial Investigation Tasks RI-2A, RI-2B, and RI-2C, and in response to remedial action response objectives determined by the Endangerment Assessment (Task EA-2).

The analysis will be complete, thorough, and all conclusions and recommendations will be justified. A complete description of each alternative shall be given. For any alternatives found unacceptable in the analysis based on screening for the criteria of:

- 1) cost,
- 2) effects, and
- 3) acceptable engineering practice

such that the alternative does not warrant a complete analysis, the justification for not considering that alternative further shall be provided.

The analysis of each alternative shall include all costs, technical feasibility, effectiveness in mitigating the contamination, adverse effects, regulatory requirements, and schedule associated with each alternative.

Included in the alternatives analysis will be an inflation analysis to show the effects of schedule on costs.

Conclusions and recommendations on the preferred remedial alternative shall be made resulting in a Record of Decision (ROD).

REMARKS

An alternative water supply as well as advanced water treatment of the existing supply will be among the alternatives considered.

The results of this task will be used to establish the technology to be designed in Task DE-2. The ROD will be submitted to EPA and CDH for their concurrence and approval, and to the public for their comment and approval.

DESIGN AND EXECUTION

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post -Compilation of Prior Design Criteria

NUMBER DE-1A

TIME FRAME START 1 Aug 85 END 1 Dec 85

MAN-YEARS 3

OBJECTIVE Coordinate, evaluate, and summarize design criteria developed in support of prior source control strategy component.

DESCRIPTION Design criteria have been developed throughout the feasibility phase. The evolving design criteria need to be coordinated, summarized, and evaluated. Following review, the criteria will be used for input to other design and execution tasks. Design criteria (or "concept" designs) previously completed for the RMA Contamination Control Program include:

- o I.T. Corporation, Sep 1984, "Concept Design of Hazardous Waste Landfill Facility."
- o Resource Consultants, Inc., Dec 1983, "Conceptual Design of Surface Water Control System for the Rocky Mountain Arsenal South Plants Area."
- o Stearns-Roger Engineering Corporation, Nov 1983, "South Plants Groundwater Treatment Pilot Plant."
- o U.S. Army Waterways Experiment Station(WES), Sep 1983, "Hydrogeology of Basin A/South Plants Area, Rocky Mountain Arsenal, Denver, CO Phase I."
- o U.S. Army WES, 1983, "Laboratory - Scale Solidification of Basin F Concentrate, Rocky Mountain Arsenal." Draft.
- o U.S. Army WES, Nov 1983, "Proposed Hazardous Waste Landfill Siting and Suitability, Rocky Mountain Arsenal."
- o U.S. Army WES, Jan 1984, "Hydrogeology of Basin A/ South Plants Area, Rocky Mountain Arsenal, Denver, CO., Phase II."

- o U.S. Army WES, Apr 1984, "Verification Studies on the Solidification of Basin F Wastes, Rocky Mountain Arsenal," Draft.

REMARKS

None.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Plug Deep Well																										
NUMBER	DE-1B																										
TIME FRAME	START	1 Oct 84	END 21 Nov 85																								
MAN-YEARS	17.0																										
OBJECTIVE	Complete closure of Deep Well																										
DESCRIPTION	<p>Task includes 1.) the preparation of design specifications in accordance with EPA plugging and abandonment regulatory requirements for the Underground Injection Control Program and 2.) the construction work required to plug the deep well and dispose of associated facilities. Current schedule is as follows:</p> <table border="0" style="width: 100%;"> <tr> <td>RMA Issue Advance Notice to Bidders</td> <td style="text-align: right;">1 Apr 85</td> </tr> <tr> <td>RMA Submit Proj to HQ AMCCOM</td> <td style="text-align: right;">12 Apr 85</td> </tr> <tr> <td>RMA Request Funds From HQ AMCCOM</td> <td style="text-align: right;">12 Apr 85</td> </tr> <tr> <td>RMA Brief Proj at AMCCOM (If Req'd)</td> <td style="text-align: right;">16 Apr 85</td> </tr> <tr> <td>HQ AMCCOM Provide RMA Proj Approval</td> <td style="text-align: right;">26 Apr 85</td> </tr> <tr> <td>Advertise for Bids</td> <td style="text-align: right;">30 Apr 85</td> </tr> <tr> <td>Site Visit (Presolicitation Conf at RMA)</td> <td style="text-align: right;">17 May 85</td> </tr> <tr> <td>RMA Issue Amend. (If Req'd.)</td> <td style="text-align: right;">20 Jun 85</td> </tr> <tr> <td>Bid Opening</td> <td style="text-align: right;">30 May 85</td> </tr> <tr> <td>Award Contract</td> <td style="text-align: right;">13 Jun 85</td> </tr> <tr> <td>Contractor Begin Work at Site</td> <td style="text-align: right;">24 Jun 85</td> </tr> <tr> <td>Contract Work Completed</td> <td style="text-align: right;">21 Nov 85</td> </tr> </table>			RMA Issue Advance Notice to Bidders	1 Apr 85	RMA Submit Proj to HQ AMCCOM	12 Apr 85	RMA Request Funds From HQ AMCCOM	12 Apr 85	RMA Brief Proj at AMCCOM (If Req'd)	16 Apr 85	HQ AMCCOM Provide RMA Proj Approval	26 Apr 85	Advertise for Bids	30 Apr 85	Site Visit (Presolicitation Conf at RMA)	17 May 85	RMA Issue Amend. (If Req'd.)	20 Jun 85	Bid Opening	30 May 85	Award Contract	13 Jun 85	Contractor Begin Work at Site	24 Jun 85	Contract Work Completed	21 Nov 85
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REMARKS	Task completed.																										

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - North Boundary System - Alterations
NUMBER	DE-1C
TIME FRAME	START 1 Oct 84 END 30 Sep 89
MAN-YEARS	16.0
OBJECTIVE	Improve system performance
DESCRIPTION	<p>An alteration contract to winterize wells, improve electrical power distribution, modify well metering system, modify water distribution piping, etc. is in progress and is expected to be completed in March 1985. This will complete the FY 85 work effort. However, the comprehensive evaluation of the North Boundary system currently in progress is expected to recommend modifications for improving system effectiveness. Implementation of these recommendations and other needed operational improvements will result in major alterations to the system. Problem areas currently identified which require improvement/modifications are:</p> <ol style="list-style-type: none">1. Evaluation of alternative recharge techniques.2. Increased recharge capacity.3. Improvement in containment of contamination migration in the alluvial/Denver aquifers.4. Development and installation of improved post filtering system.5. Improvements in treatment process component equipment.6. Development of improved operational procedures.7. Development of improved maintenance program (procedures, spare parts requirements, etc.).8. Installation of automated process data collection system.9. Development and installation of automated process controls.10. Installation of additional wells for system monitoring.
REMARKS	<p>This task includes engineering evaluation, development of specifications and design criteria, design engineering, and alterations/construction of projected modifications to the system. Task resource estimate includes labor, materials, and equipment.</p>

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Northwest Boundary System - Alterations

NUMBER DE-1D

TIME FRAME START 1 Oct 84 END 30 Sep 89

MAN-YEARS 9.0

OBJECTIVE Improve system performance

DESCRIPTION Results of initial operations of the Northwest Boundary system have indicated serious operational problems. RMA is currently proceeding with design engineering (contractor effort) to modify Northwest Boundary system. Problem areas currently being investigated by the design engineering contractor include:

- a. Improvements to the pre-filtering and post-filtering system.
- b. High water level automatic shut-off controls for the influent sump pumps.
- c. Installation of dewatering well pump indicator lights and automated controls in treatment plant.
- d. Additional process control valves and electrical controls in the treatment plant and dewatering well distribution system.
- e. Provision for transfer of waste carbon from the waste sump to the spent carbon storage tank.
- f. Installation of fixed stairs/platforms to service the adsorbers.
- g. Installation of treatment plant effluent flow meters.
- h. Modification to well valve pit covers.
- i. Provision for transfer of backwash carbon from the post-filter to the spent carbon storage tank.

The construction phase of the current alteration project could be initiated in 4 Qtr, FY85, with completion in FY86. Other modifications to improve operational effectiveness are needed in the following areas:

- 1. Development of improved operational procedures.
- 2. Development of improved maintenance program (procedures, spare parts requirements, etc.).
- 3. Installation of automated process data collection system.

4. Installation of additional wells for system monitoring.

REMARKS

This task includes engineering evaluation, development of specifications and design criteria, design engineering, and alterations/construction of projected modifications to the system. This task and Task DE-1C will be consolidated during implementation. Task resource estimate includes labor, materials, and equipment.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Waste Salts Disposal

NUMBER DE-1E

TIME FRAME START 2 Aug 85 END 30 Sep 86

MAN-YEARS 85

OBJECTIVE Dispose of 70,000 drums of waste salts now stored at the Arsenal.

DESCRIPTION RMA currently stores over 70,000 drums of waste salts resulting from various demilitarization activities on the Arsenal. Drums are stored out of compliance with EPA regulations and must be disposed of. Present disposal plans are to have a contractor dispose of the 70,000 drums of waste salts in a RCRA approved landfill outside the State of Colorado. Current schedule for waste salts disposal is as follows:

	<u>Phase 1</u>	<u>Phase 2</u>
Complete design	2 Aug 85	9 Aug 85
Issue RFP/RFQ	5 Aug 85	12 Aug 85
Receive bids	23 Aug 85	19 Sep 85
Award contract	10 Sep 85	26 Sep 85
Initiate disposal	19 Sep 85	20 Jan 86
Complete action	17 Jan 86	30 Sep 86

REMARKS \$8.5M for waste salt disposal has been approved.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Fugitive Dust Control
NUMBER	DE-1F
TIME FRAME	START 1 Apr 86 END 31 Mar 87
MAN-YEARS	1.0
OBJECTIVE	To define control measures for the movement of potentially contaminated fugitive dust from problem source areas on Rocky Mountain Arsenal.
DESCRIPTION	The purpose of this task is to provide an interim measure for dust suppression prior to site decontamination. Remedial investigations now ongoing will destroy most if not all of the current dust suppression material applied to Basins A and F. An updated alternatives evaluation for dust control including cover vegetation, dust palliative application, physical measures, and various surface treatments will be conducted. The most cost-effective dust control measure will be selected for implementation in the field.
REMARKS	Coordinate this task with the Air/Dust Feasibility Study, FS-1C4.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE On-Post - Basin F Closure

NUMBER DE-1G

TIME FRAME DESIGN START 1 Jan 87 END 31 Dec 88
 CONSTRUCTION START 1 Jul 88 END 30 Jun 91
 OPERATIONS START 1 Jul 89 END 30 Jun 92

MAN-YEARS 80 (Design and Execution)

OBJECTIVE To close Basin F according to RCRA regulations.

DESCRIPTION This project provides for engineering design and construction to remove contaminated liquid, sediment liner and sub soils for treatment and on site disposal in a high technology hazardous waste disposal facility (landfill). A preliminary concept design has been completed for physical removal of the basin to a solidification facility and construction of a liquid-free landfill estimated to encapsulate 600,000 cubic yards of material. The Basin F area will be recontoured and revegetated. Treatment technologies are now being evaluated as an alternative to solidification.

REMARKS An alternatives assessment will be done to select technologies and alternatives prior to initiation of the final closure design. This task is being integrated with FS-1C1 incineration, FS-1C2 solidification, and FS-1D landfill disposal. These feasibility study tasks will not be completed until 30 Sep 87.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE Lower Lakes Sediment Removal

NUMBER DE-1H

TIME FRAME START 1 Jul 85 END 30 Oct 87

MAN-YEARS 50.0

OBJECTIVE Remove sediments from Lower Lakes

DESCRIPTION Dry portions of Upper and Lower Derby have been found to contain high levels of pesticides and mercury. These sediments must be removed to prevent an environmental danger to migratory wildlife foraging at these sites. Design of the lake sediment removal project will be completed to meet State of Colorado waste pile regulations. Permits will be developed as required while maintaining regulatory agency interface. Support will be given to the selected cleanup contractor and COR during field operations. Upon completion of decontamination activities, an evaluation of the beneficial impact on fish and wildlife will be conducted to examine the population and habitat.

REMARKS None

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Upgrade Sanitary Sewer
NUMBER	DE-11
TIME FRAME	START 1 Jul 85 END 30 Sep 86
MAN-YEARS	20
OBJECTIVE	To repair active portions of sewer line and block off/remove inactive portion of sewer line to eliminate infiltration/exfiltration to the system.
DESCRIPTION	Based on a TV camera survey of the sanitary sewer system, the entire system is being evaluated for repairs and modifications. All inactive portions of the system will be blocked off, and damaged portions of the sewer line will be excavated and/or repaired. In-situ lining will be conducted where necessary to improve performance of the system.
REMARKS	Currently in preliminary design review phase as project # RMA-0019-80.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE On-Post - Design Criteria Development

NUMBER DE-1J

TIME FRAME START 1 Oct 87 END 30 Sep 88

MAN-YEARS 36.0

OBJECTIVE Develop concept designs and/or design criteria for all Rocky Mountain Arsenal cleanup activities and facilities.

DESCRIPTION Concept designs and/or design criteria must be compiled and refined for those remedial actions resulting from the alternatives assessment. Level of detail for the resulting design criteria will be compatible with a conventional design level, which will identify data analysis to be performed before proceeding with latter stages of design (e.g., 90% level). Design criteria will include:

- o Initial conceptual layout (with drawings) of facilities.
- o Description of phasing necessary for project.
- o Description of operation and maintenance activities.
- o Initial project cost estimate.
- o Initial project specifications.
- o Process flow sheets with critical design parameters.

REMARKS May extend into FY89.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Final Design of Remedial Facilities
NUMBER	DE-1K
TIME FRAME	START 1 Oct 88 END 30 Sep 91
MAN-YEARS	100
OBJECTIVE	Develop detailed design for drawings and construction specifications for all cleanup activities and facilities.
DESCRIPTION	Detailed engineering design drawings and specifications will be developed for landfills, treatment equipment, wastewater treatment, and all ancillary facilities required for cleanup and decontamination.
REMARKS	May need to begin earlier than 1 Apr 87.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Off-Post - Alternate Water Source
NUMBER	DE-2
TIME FRAME	START 1 Jul 87 END 31 Mar 88
MAN-YEARS	40
OBJECTIVE	Design and execution of off-post facilities and utilities.
DESCRIPTION	It is possible that some off-post utilities (such as water supply) may have to be provided to nearby landowners. These utilities will require development of detailed design and construction specifications of necessary facilities.
REMARKS	The assumption of an Alternate Water Source as a remedial action is used for scoping purposes. Actual remedial action will be based on the selected alternative developed in Task FS-2A. It is assumed that South Adams County will be responsible for construction of any regional water distribution system. The Army will fund and provide input to design efforts. Resource estimate includes materials, supplies, and labor.

OPERATION AND MAINTENANCE

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - North Boundary System Operation
NUMBER	OM-1A1
TIME FRAME	START Ongoing END 30 Sep 89 (Phase I)
MAN-YEARS	37
OBJECTIVE	To contain and treat contaminated ground water.
DESCRIPTION	Operate, maintain and repair the North Boundary containment/treatment system. This system involves the operation of a carbon absorption treatment plant connected to 54 dewatering wells and 38 recharge wells. Operational data are maintained on system performance. Water quality is monitored to assure treatment process is operating effectively. Operating performance is evaluated and process improvement criteria are developed for required modifications to enhance system performance. Operating procedures, maintenance logs, and spare part inventory data are established and maintained. Maintenance and repair of the system is performed as required.
REMARKS	Estimate includes resources to operate, maintain, and monitor the system. System requires three shifts per day of operating support. Methods and modification to reduce operator attention through improved instrumentation are being designed in Task DE-1C. The operations task will continue beyond Phase I of the program and will continue until cleanup is achieved.

TITLE	On-Post - Northwest Boundary System Operation		
NUMBER	OM-1A2		
TIME FRAME	START	Ongoing	END 30 Sep 89 (Phase I)
MAN-YEARS	46		
OBJECTIVE	To contain and treat contaminated ground water		
DESCRIPTION	<p>Operate, maintain, and repair the Northwest Boundary containment/treatment system. This system involves the operation of a carbon absorption treatment plant connected to 15 dewatering wells and 21 recharge wells. Operational data are maintained on system performance. Water quality is monitored to assure treatment process is operating effectively. Operating performance is evaluated and process improvement criteria are developed for required modifications to enhance system performance. Operating procedures, maintenance logs, and spare part inventory data are established and maintained. Maintenance and repair of system is performed as required.</p>		
REMARKS	<p>Estimate includes resources to operate, maintain, and monitor the system. System requires three shifts per day of operating support. Methods and modifications to reduce operator attention through improved instrumentation are being designed in Task DE-1D. The operations task will continue beyond Phase I of the program and will continue until cleanup is achieved.</p>		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE	On-Post - Basin F Evaporation
NUMBER	OM-1A3
TIME FRAME	START Ongoing END 30 Sep 88
MAN-YEARS	12
OBJECTIVE	To reduce Basin F liquid content
DESCRIPTION	Operate, maintain, and repair the Basin F enhanced evaporation system. Redesign of the system is in progress. Modification to system scheduled to be complete in 3rd Qtr, FY 85. Operation of system will be resumed and will continue until liquid content is minimized and/or other treatment techniques are employed. This task includes only operation and maintenance of system equipment and does not include design engineering and construction programmed in FY 85.
REMARKS	Will be operated until Basin F closure activities start.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post Sewage Treatment Plant, Tertiary Treatment and Laboratory Waste Tank Treatment		
NUMBER	OM-1A4		
TIME FRAME	START	Ongoing	END 30 Sep 89
MAN-YEARS	10		
OBJECTIVE	To treat contaminated effluent from Sewage Treatment Plant and contaminated water from laboratory operations.		
DESCRIPTION	<p>Operate, maintain, and repair tertiary treatment system on the outfall of the Sewage Treatment Plant. Operational data are maintained on system performance. Water quality is monitored to assure treatment process is operating effectively. Operating performance is evaluated and process improvement criteria are developed for required modifications to enhance system performance. Operating procedures, maintenance logs, and spare part inventory data are established and maintained. Maintenance and repair of system is performed as required.</p> <p>Operate, maintain, and repair the carbon/alumina treatment system on the effluent side of the 170,000 gallon storage tank located in the South Plants area. Water quality data are submitted as partial requirement for the NPDES discharge permit reports.</p>		
REMARKS	None.		

TITLE	On-Post Boundary Systems - Monitoring and System Evaluation		
NUMBER	OM-1B1		
TIME FRAME	START	Ongoing	END 30 Sep 89
MAN-YEARS	15		
OBJECTIVE	Evaluate impact of Boundary Systems (North, Northwest, and Irondale) on RMA ground water.		
DESCRIPTION	<p>Monitor ground water levels and water quality in areas impacted by boundary contamination control systems. Conduct field sampling on a periodic basis, maintain sampling equipment, prepare reports indicating ground water movement and contamination profiles. Using monitoring data and contamination control boundary system operational data, evaluate total system effectiveness to locate, treat, and control contaminated ground water. Prepare annual report of system operational status and effectiveness. Recommend system operating strategies to optimize effectiveness. Recommend system modifications/improvements to enhance system performance.</p>		
REMARKS	<p>Shell Oil Company's operational monitoring data from the Irondale system will be incorporated into this task.</p>		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post Ground Water Monitoring Programs
NUMBER	OM-1B2
TIME FRAME	START 1 Apr 86 END 30 Sep 89
MAN YEARS	45
OBJECTIVE	To provide Arsenal-wide monitoring of ground and surface water quality.
DESCRIPTION	Included in this task are; the 360 degree monitoring program which provides a continuous Arsenal wide viewpoint of ground and surface water quality from established sample sites; monitoring of secondary contamination sites ground water quality; monitoring of surface water flow and water quality; and monitoring required for the Basin F RCRA compliance program. Work includes field sampling from wells and surface water sites and review and evaluation of analytical data. Annual reports to include formal RCRA report to EPA relative to Basin F.
REMARKS	Resource estimate includes cost of sampling and analysis, and cost of monitoring report preparation.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post Ecology
NUMBER	OM-1B3
TIME FRAME	START 1 Apr 86 END 30 Sep 89
MAN-YEARS	6
OBJECTIVE	Monitor wildlife and flora for contamination uptake from the environment.
DESCRIPTION	<p>Use information for required Federal reports and Rocky Mountain Arsenal Environmental Assessments and Environmental Impact Statement and Resource Conservation and Recovery Act (RCRA) permit applications.</p> <p>Conduct periodic sampling and chemical analysis for preparation of annual biological monitoring report.</p> <p>Support preparation of project Environmental Assessments for lower lakes, deep well closure, Basin F closure and major construction, and Army projects.</p>
REMARKS	None

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Air Monitoring
NUMBER	OM-1B4
TIME FRAME	START 1 Oct 86 END 30 Sep 89
MAN-YEARS	12
OBJECTIVE	To operate and maintain the air pollution monitoring systems.
DESCRIPTION	Air pollution monitoring systems will be operated to determine the impact of Arsenal operations as opposed to impacts from off-post facilities and activities. Data will be collected to determine ambient concentrations of particulates, vapors, and specified contaminants. Standard climatic data, such as wind speed and direction and precipitation, will also be collected. Equipment will be maintained and repaired or replaced, as needed.
REMARKS	None

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	On-Post - Fugitive Dust Control
NUMBER	OM-1B5
TIME FRAME	START 1 Jan 87 END 30 Sep 89
MAN-YEARS	2.5
OBJECTIVE	Monitor the effectiveness of control efforts in place to minimize the movement of potentially contaminated fugitive dust from problem source areas on RMA.
DESCRIPTION	Dust suppression techniques applied in 1983 and 1986 will be monitored for effectiveness. A comparison will be made between the two applications to determine the degree of degradation over time. Recommendations from Task FS-1C4 for suppression technology to control fugitive dusts during construction will be evaluated.
REMARKS	None

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Off-Post Interim and Final Remedial Actions (Alt. Water Source)		
NUMBER	OM-2		
TIME FRAME	START	1 Jan 86	END 30 Sep 89
MAN-YEARS	13		
OBJECTIVE	Develop and implement a program for interim and long-term operation of off-post facilities.		
DESCRIPTION	Any facilities constructed off-post, such as an alternate water supply for nearby landowners, will require long-term operation. A plan needs to be developed and implemented.		
REMARKS	None		

PROGRAM MANAGEMENT

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Program Manager's Office
NUMBER	PM-1
TIME FRAME	START 1 Jul 85 END 30 Sep 89
MAN-YEARS	13
OBJECTIVE	Establish an office to provide overall leadership and direction of the cleanup of RMA.
DESCRIPTION	The Commander, USATHAMA, was designated Program Manager for the RMA cleanup program by letter on 25 Feb 85. A concept plan for PM office implementation has been prepared detailing the proposed PM charter and organizational structure. The plan includes the proposed communication channels to be followed, identifies additional resources required, and delineates responsibilities of all participating activities. As currently organized, this office consists of the program manager, a deputy, and necessary secretarial/clerical support.
REMARKS	Although the end of the time frame is shown as 30 Sep 89, this office will continue to exist until the program is completed.

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE	Program Manager's Staff Office (Operations/ Monitoring)		
NUMBER	PM-2		
TIME FRAME	START	1 Oct 85	END 30 Sep 89
MAN-YEARS	24		
OBJECTIVE	Establish an operations office to direct and monitor all cleanup operations at RMA.		
DESCRIPTION	This office will be the responsible office for all cleanup operations. The chief of this office will report directly to the deputy program manager, develop milestones, coordinate all cleanup activities, and monitor all activities to insure timely completion.		
REMARKS	It is expected that this office will continue to operate until the entire program is completed.		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Environmental Engineering Division
NUMBER	PM-3
TIME FRAME	START 1 Jul 85 END 30 Sep 89
MAN-YEARS	54
OBJECTIVE	Establish an Environmental Engineering Division to plan and coordinate all RI/FS efforts.
DESCRIPTION	Responsible for all projects, studies, and assessments dealing with Remedial Investigations, Endangerment Assessment, Feasibility Studies, and Design/Execution. Located at APG during the initial part of Phase I. Responsible for providing guidance for field activities. Substantial interrelationship with RMA will be necessary to coordinate environmental compliance and facility engineering activities.
REMARKS	None

ROCKY MOUNTAIN ARSENAL
TASKS DESCRIPTIONS

TITLE	Program Coordination Division
NUMBER	PM-4
TIME FRAME	START 1 July 85 END 30 Sep 89
MAN-YEARS	65.0
OBJECTIVE	Establish an advisory staff supporting PMO, planning and field activities.
DESCRIPTION	This staff will be responsible for providing legal, public information, data management, permitting and procurement support. These functions will either be managed internally or through interface with other divisions.
REMARKS	Expect office will continue on after 30 Sep 89 and until program is completed.

PROGRAM SUPPORT

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Permitting (Identification, Preparation, Filing and Approvals)		
NUMBER	PS-1		
TIME FRAME	START	Ongoing	END 30 Sep 89 (Phase I)
MAN-YEARS	40		
OBJECTIVE	Identify permit needs, file as appropriate and follow up until completion and issuance.		
DESCRIPTION	Numerous permits will be required to implement the feasibility studies as well as the final cleanup. Permit procurement requires filing, agency interaction, and final issuance.		
REMARKS	This task must be closely integrated with other tasks involved with projects that require permits, such as landfill site selection and design and pollution control facilities. Appendix D lists applicable and relevant permits required.		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Legal Support	
NUMBER	PS-2	
TIME FRAME	START Ongoing	END 30 Sep 89
MAN-YEARS	8	
OBJECTIVE	Provide para-legal support to the entire PMO.	
DESCRIPTION	The following activities will be supported: <ul style="list-style-type: none">o Permit preparation and submission.o Advising PM on regulatory matters.o Coordinating leasehold field activities with Shell Chemical Companyo Coordinating PMO activities with DA/DOJ litigation team.o Attendance at MOA meetings.o Monitoring upcoming Federal and Colorado regulatory legislation.	
REMARKS	None	

TITLE	Public Affairs/Community Relations		
NUMBER	PS-3		
TIME FRAME	START	Ongoing	END 30 Sep 89
MAN-YEARS	12		
OBJECTIVE	Develop, coordinate and implement a community relations program to assist in community acceptance of RMA goals and programs.		
DESCRIPTION	It is important that a community relations program be developed and implemented so that RMA programs can be presented to the public in advance and with an educational perspective. The program will include public meetings and media presentations, as necessary, to ensure media compliance.		
REMARKS	None.		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTION

TITLE	MOA Coordination	
NUMBER	PS-4	
TIME FRAME	START Ongoing	END 30 Sep 89
MAN-YEARS	6	
OBJECTIVE	Coordinate the various active agencies through the project.	
DESCRIPTION	<p>A Memorandum of Agreement (MOA) was signed in Dec 83 between Colorado Dept of Health, EPA, Shell Chemical Company and the Army to facilitate implementation of the Installation Restoration Program at RMA. In addition to monitoring the ongoing survey phases of the IR program, the MOA allows for the cooperative development of a comprehensive remedy for environmental contamination at the Arsenal.</p> <p>As the technical program contained in this document progresses toward implementation, the MOA will gain in importance and intensity. Special emphasis will be necessary in 87/88 to coordinate Army activities with the other parties. This task focuses ongoing Army efforts into the various task groups that are forming under the MOA umbrella.</p>	
REMARKS	None	

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Data Management	
NUMBER	PS-5	
TIME FRAME	START Ongoing	END 30 Sep 89
MAN-YEARS	18	
OBJECTIVE	Coordinate and implement a total project data management system.	
DESCRIPTION	<p>Given the large amount of data which will be produced in the RI, FS, and operation support functions, the IR computerized data management system will need to be refined and maintained.</p> <p>In addition, a system of information flow will be developed so that all elements involved in RMA work would be able to communicate readily utilizing personal computer network and telephone systems. The extreme urgency of these operations often requires immediate access to program data. With IBM personal computer linkups to the program database, data and other information may be accessed and transferred by authorized personnel in order to keep "up to the minute" on activities taking place regarding the Arsenal.</p> <p>The litigation microfilm database will be integrated with the RMA Information Center (RIC) to provide a hard copy repository of all project related documentation. The principal center location will be at RMA with a satellite center at the PMO in APG, MD. Microfilm data bases may be kept by several key consultants as a litigation related source area.</p>	
REMARKS	None	

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Simulation and Systems Analysis		
NUMBER	PS-6		
TIME FRAME	START	1 Oct 85	END 30 Sep 89
MAN-YEARS	12		
OBJECTIVE	Implement a simulation and systems analysis program that will be capable of evaluating impact of future scenarios.		
DESCRIPTION	<p>Even though the cleanup program will provide total cleanup, an analysis of impacts of future scenarios on environmental migration effects is required.</p> <p>Past computer modeling efforts by A.D. Little, Computer Sciences Corporation, Geraghty and Miller, ERTEC, D'Appolonia and Earth Sciences Association will be reviewed for applicability. The recent MITRE modeling assessment for USATHAMA will also be analyzed. System installation and calibration will be completed in 87 allowing use with the Alternatives Assessment Task FS-11.</p>		
REMARKS	None		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Analytical Chemistry/Quality Control/Quality Analysis (QC/QA)		
NUMBER	PS-7		
TIME FRAME	START	Ongoing	END 30 Sep 89
MAN-YEARS	21		
OBJECTIVE	Develop and implement a QC/QA program, throughout the project, with regard to data collection, analysis, and design.		
DESCRIPTION	<p>An internal QC/QA program is required due to the large amount of monitoring data, studies, and design criteria which will be developed.</p> <p>Maintain a well trained staff of professionals that provides accurate and precise analytical test results in accordance with an established quality control plan. Use up-to-date analysis procedures to support the ongoing studies of the program and provide test results that enable RMA to meet the requirements of RCRA and NPDES permits. Coordinate with DOJ expert witnesses. Review weekly QC charts from all Government and contract laboratories.</p>		
REMARKS	None		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Criteria Development
NUMBER	PS-8
TIME FRAME	START Ongoing END 30 Sep 86
MAN-YEARS	5
OBJECTIVE	Develop criteria to determine action levels of contaminants.
DESCRIPTION	Criteria must be established to determine what materials will be considered contaminated and what will be considered clean. These criteria will be used to identify the extent and magnitude of the cleanup effort and what remedial facilities and processes will be needed. Much of this information will be developed from USAMBRDL's Preliminary Pollutant Limit Values.
REMARKS	None

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Health and Safety
NUMBER	PS-9
TIME FRAME	START Ongoing END 30 Sep 89
MAN-YEARS	25
OBJECTIVE	Implement and execute a comprehensive health and safety program.
DESCRIPTION	For RMA personnel, contract personnel, nearby residents, and throughout data collection, feasibility analysis, design, and construction, a comprehensive health and safety program is required. This program must address all OSHA requirements.
REMARKS	None

TITLE	Resource Management		
NUMBER	PS-10		
TIME FRAME	START	Ongoing	END 30 Sep 89
MAN-YEARS	38		
OBJECTIVE	Support resource management activities for the Program Manager.		
DESCRIPTION	This support will be responsible for the planning, programming and budgeting of funds and manpower.		
REMARKS	It is expected that this office will continue to operate after 30 Sep 89 and until the program is completed.		

ROCKY MOUNTAIN ARSENAL
TASK DESCRIPTIONS

TITLE	Litigation Support		
NUMBER	PS-11		
TIME FRAME	START	Ongoing	END 1 Oct 87
MAN-YEARS	30		
OBJECTIVE	Provide technical support to the ongoing litigation cases.		
DESCRIPTION	<p>During FY86, litigation support of a technical nature will be focused in three main areas:</p> <ul style="list-style-type: none">o The lawyers will have millions of pages of documents at their disposal in preparing the case. There will be an ongoing need to provide technical interpretation to the legal staff and to answer questions which may arise after reviewing the supporting material.o As data from the various survey tasks are compiled, there will be a need to provide technical support in developing allocation plans pertinent to litigation, based on these data.o In addition, there is a continuing need to update responses to litigation interrogations as additional information is uncovered, as well as providing pertinent information to RI/FS Field Teams. <p>During the outyears beyond FY86, the above mentioned support to the legal counsel in handling matters of technical interpretation will take place. In addition, there will be support needed from several expert consultants in both the courtroom and field survey areas. The testimony of the expert consultants as well as their support to surveys and necessary follow-up on programs will be necessary to the litigation and Arsenal cleanup.</p>		
REMARKS	<p>Work under this task will essentially be carried out on an "as required" basis.</p> <p>The final trial is expected to commence late 1987 with an expected completion date in 1988. However, it is possible that events could stretch well into 1989.</p>		

APPENDIX C
COMMENTS AND RESPONSES

COMMENTS AND RESPONSES

COLORADO DEPARTMENT OF HEALTH (CDH)

COMMENT NUMBER: 1

REFERENCE: Task PS-1

COMMENT: For several of the actions described in the remedial response strategy, the Army will be required to obtain State permits or approvals before implementation can occur.

RESPONSE: The Army will obtain all necessary permits and/or approvals. The Army's position relative to Colorado Hazardous Waste Act applicability to CERCLA cleanup is still being formulated. Initial guidance is that the Colorado Hazardous Waste Act will be followed in a substantive manner. The Army also feels that the time frames shown for obtaining permits are sufficient, assuming timely CDH review and approval.

COMMENT NUMBER: 2

REFERENCE: Tasks FS-2A and DE-2

COMMENT: The Off-post Alternate Water Source task description discusses the possibility of providing utilities (such as water supply) to nearby landowners. We recommend that this task be expanded to also be a "long-term" objective to consider assessing advanced treatment for the South Adams Water District since these landowners are to be supplied by the district in the future.

RESPONSE: Agreed. Off-post Alternatives Assessment (FS-2A) which takes place prior to the Alternative Water Source Selection (DE-2) will assess all reasonable solutions to any Arsenal-related contamination.

The alternatives analysis will be conducted using data compiled from monitoring conducted in Tasks RI-2A and RI-2B, and prior to Task DE-2, the design of the off-post remedial action.

Alternate water supply as well as advanced treatment of the existing water supply will be among the alternatives considered.

Alternate water supply may be the likely solution since previous Army experience across the country has shown alternative water supplies as the preferred remedy. This alternative, however, is only an indication of possible direction for scoping purposes for design and execution (DE-2).

COMMENT NUMBER: 3

REFERENCE: RI-2A

COMMENT: The Off-post Groundwater and Surface Water Monitoring tasks currently call for a single sampling event to characterize off-post contamination. This is clearly insufficient as it does not evaluate seasonal fluctuations and variations in surface and ground water quality. The program must be expanded to provide quarterly sampling and analysis efforts for as long as warranted and for development of a potentiometric surface map for data interpretation.

RESPONSE: Off-post Groundwater/Surface Water Remedial Investigation Monitoring (RI-2A and RI-2B) are planned to include more than one sampling, and the study's purpose is to provide both a short-term picture of the current off-post situation using new data and development of a long-term prognosis of off-post contaminant migration. The use of data trends allows remedial action feasibility studies to be initiated. This activity will take place through mid-FY86. Long-term monitoring will be part of the off-post O&M task (OM-2) - starting in mid-FY86.

To date, over 100 consumptive use wells have been sampled. For those areas of concern, an additional sampling of 30 wells was accomplished. Currently, 40 wells will be installed by mid-October 85. Thirty wells will be sampled by 31 December 85. A second sampling event is scheduled for completion by 31 March 1986. Sampling events for an additional two quarters are planned. The discussions for Tasks RI-2A and RI-2B have been revised to clarify the Army's program.

COMMENT NUMBER: 4

REFERENCE: Task FS-1C1

COMMENT: The On-post Incineration task objective should be expanded to include the definition of steps necessary for the implementation of full-scale incineration treatment on the Arsenal property.

RESPONSE: Agree. The identification of steps necessary for full-scale implementation of incineration will be included in this task. Also included in the revision are the determination of the type of incineration system, development of full-scale design criteria, determination of ash disposal, and preparation and submission of permit applications.

Also refer to Shell Comment 3.

COMMENT NUMBER: 5

REFERENCE: FS-1D

COMMENT: The On-post Landfill Disposal task description must be expanded to assess off-site management of hazardous waste at in-state facilities that may be available within the timeframe proposed for removal and consolidation of source area contamination.

RESPONSE: The task description as stated was too restrictive and has been changed to include the evaluation of both on-site and off-site landfill disposal options. Mr. Shannon's letter to Governor Lamm (1 February 1985) summarizes the Army's position on landfill disposal. The Army is principally focusing on on-site landfills and will evaluate off-site landfills permitted in the State that are potentially suitable sites.

COMMENT NUMBER: 6

REFERENCE: RI-2C

COMMENT: On/Off-post - Biota Monitoring should also include migratory ducks species. There is a substantially greater likelihood of off-post public consumption of wild ducks, and most of these species are bottom (sediment) feeders.

RESPONSE: This task will be conducted in two phases. In Phase I, biota examinations have been prioritized to look at species with known linkage to the arsenal, high likelihood of significant biological uptake, known geographic dispersion to off-post areas (eg., pheasants), and consumed by the off-post public. Migratory ducks are not easily studied and do not possess a clear geographic dispersion pattern off-post. Phase 2 examinations may include ducks if it is found that they represent a pathway to the off-post population.

COMMENT NUMBER: 7

REFERENCE: FS-2A

COMMENT: The Off-post Alternative Assessment task description does not comply with the National Contingency Plan in that the alternatives under consideration are being limited to provided water supply as the only alternative. The remedial alternatives for off-site contamination should be expanded to include all alternatives that effectively mitigate public exposure and minimize environmental damage off-site.

RESPONSE: Refer to CDH Comment Number 2.

COMMENT NUMBER: 8

REFERENCE: DE-1G

COMMENT: The design phase for Basin F closure is projected from 1 October 87 to 30 September 91. This constitutes a two-year delay for initiation and a four-year allotment for design activities. This is unsatisfactory and no justification, as required by the Colorado Hazardous Waste Act, is provided for the initial delay and lengthy design phase.

RESPONSE: The task description did not clearly identify the design and execution schedule. Task DE-1G, On-post Design and Execution for Basin F closure, is scheduled for 1 October 87 through 30 September 91 for the entire design, construction, operational, and closure phase. This time frame is currently projected to be as follows: Design - start 1 October 87, ending 31 March 88; Construction start 1 October 88, ending 30 September 89. Operations/closure will run from 1

October 89 to 30 September 91. The difference of two years is due to feasibility study work which supports Basin F waste pretreatment. These feasibility studies involving incineration and/or solidification tasks will not be completed until 30 September 87.

COMMENT NUMBER: 9

REFERENCE: OM-1A1 and OM-1A2

COMMENT: The end dates projected for the North, Northwest, and Irondale boundary system operations and On-post Groundwater Monitoring Program (30 September 89) are optimistic considering source clean-up occurs mostly in 1990 and beyond. These dates should be revised accordingly.

RESPONSE: Agree. This Phase 1 plan covers from the present through 1989. The O&M program as shown on Page 12 continues through the year 2000 and beyond. Ground water system operations and monitoring will continue until contaminant concentrations are below action levels.

COMMENT NUMBER: 10

REFERENCE: RI-1C and RI-21

COMMENT: The On-post Groundwater Monitoring Program should be expanded to include adequate off-post monitoring to evaluate public health risk and environmental impacts from contaminants that have migrated beyond Arsenal boundaries.

RESPONSE: See Comment 3 for off-post study clarification. On-post remedial investigation is limited to Arsenal property only. The off-post program is discussed in Task RI-2A. The confusion in the two tasks may be due to the fact that one performer, Environmental Science and Engineering, Inc., is doing both the on- and off-post monitoring.

ENVIRONMENTAL PROTECTION AGENCY

COMMENT NUMBER: 1

REFERENCE: Task FS-1D

COMMENT: While on-post disposal of treated wastes is the preferred alternative, the plan should specify that other alternatives will be evaluated during the feasibility study. Specifically, off-post disposal should be evaluated as an option in the feasibility study. See proposed revisions to the National Contingency Plan, 50 Fed. Reg. 5906 (February 12, 1985). The plan should not assume that only alternatives within the Army's proposed remedial action strategy will be evaluated during the feasibility study.

RESPONSE: Agree. See CDH Comment 5.

COMMENT NUMBER: 2

REFERENCE: Tasks DE-2 and FS-2A

COMMENT: In addition to substitute water supplies, the off-post alternatives assessment should look at other remedial alternatives for correcting off-post ground and surface water contamination.

RESPONSE: Agree. See CDH Comments 2 and 7.

COMMENT NUMBER: 3

COMMENT: The plan should specify that remedial action will be conducted in compliance with applicable and relevant environmental laws, to be consistent with the revised NCP.

RESPONSE: Agree. Applicable and relevant environmental laws will be considered in the evaluation of alternatives and development of cleanup actions.

COMMENT NUMBER: 4

COMMENT: Several interim remedial measures are identified in the

Plan (i.e., plugging the deep well, disposing of the waste salts, etc.). We consider to be among such measures the unlisted RCRA closures at the DPDO and hydrazine blending facilities. We would like to discuss with you the following other possible projects which might be similarly implemented before the long-term remedy(s) is identified: managing the ground water mound under the South Plants area, close in ground water intercept and treatment systems, and management of the probable Nemagon (DBCP) spill in the rail yard.

RESPONSE: Agree. However, it is difficult if not impossible to implement other projects prior to identification of remedial strategy - March 87. Between now and 1990, other possible actions may be done to speed up the process. We are prepared to enter into these discussions at any time in order to begin scoping of accelerated outyear efforts.

SHELL CHEMICAL

COMMENT NUMBER: 1

REFERENCE: Overall Comment

COMMENT: Shell incorporates by reference its comments of December 26, 1984, on the Army's October 22, 1984 "Revised Strategy." In particular, we reiterate the statement that the Army, in proposing a new concept, has not provided a scientific, technical, factual, or legal reason for departing from its prior strategy, i.e., control containment strategy.

In general, Shell finds that the conceptual plan presented does not provide for a balanced and systematic development of remedial alternatives. Shell believes the work effort proposed could be reduced in scope and redirected to provide a more effective remedial program. The program schedule appears to be condensed and decision points are reached prior to having developed the necessary input upon which to base the decisions.

The RMA is probably the most thoroughly studied site containing hazardous materials, and the Army is considering expenditure of an additional \$140MM. This is in addition to the funds already expended.

RESPONSE: EPA and the State of Colorado are endorsing the policy of cleanup. The contamination control strategy was selected by a knowledgeable multidisciplinary team using data collected between 1974 and 1981 to develop and evaluate several strategies to meet acceptable regulatory levels as well as other strategy constraints. The strategy of cleanup was considered to be the most appropriate based on this evaluation.

The Draft/Phase 1 Technical Program Plan did not clearly delineate the steps in the alternative analysis nor the pilot studies. The revised Phase 1 Technical Program Plan and revised schedule (Figure 2) expand upon the steps of the remedial alternative analysis, the development of advanced technologies, and the performance of pilot and demonstration studies.

The 1400 man-years represents the resources projected by the Phase 1 Program and not only includes the cost of the remaining study, but also costs for continued operations and maintenance of the existing control system, cleanup of Basin F, disposal of the waste salts as well as other planned action. The study program therefore represents only a portion of the total resources.

COMMENT NUMBER: 2

REFERENCE: Overall Comment (Page 11, Page 13, FS-1C1, FS-1J, FS-1B, FS-1I, and PS-8)

COMMENT: The Phase I Technical Program does not provide for the balanced and systematic development of remedial alternatives. Rather, it is centered on the Option 1 Plan set forth in the decontamination assessment report which is currently called the revised strategy of October 1984. CERCLA requires evaluation of several alternatives which differ by degree of mitigation of risk to the public health, welfare, and the environment, including the no-action alternative. In this connection, Shell reiterates the position stated in its December 26, 1984 letter that the options described in the decontamination assessment report are not, and do not purport to be, evaluations of alternative remedial measures. The technical feasibility, risks, effectiveness, costs, and other elements of Option 1 have yet to be documented and evaluated. Shell believes that the Army's conceptual strategy of excavation, incineration, and landfilling of massive columns of soil may be found sorely wanting in terms of its net effect on mitigation of public health, welfare, and environmental risk. Sound engineering practice requires objective consideration of other strategies in the development and execution of the technical program.

RESPONSE: The Army does intend to conduct an alternatives analysis (feasibility study) following CERCLA guidance to identify, screen, evaluate, and select appropriate and cost-effective alternatives. This activity (Task FS-1I) includes using the criteria developed in the Criteria Development Task (Task PS-8) and the product of the risk assessment (Endangerment Assessment, Task EA-1) as a basis for determining action and cleanup levels.

In performing the alternatives analysis, all available demonstrated technologies and cleanup methodology which are consistent with the strategy of cleanup will be considered. Rationale for elimination of a technology or method will be documented and presented. In following CERCLA guidance, the "No Action" alternative will also be assessed.

A recommended alternative(s) will be selected through a rigorous procedure including:

- (1) documentation of performance (if necessary through pilot testing);

- (2) a risk assessment associated with the implementation of the alternative, including public health and environmental benefits;
- (3) a cost analysis; and
- (4) a regulatory compliance review.

The result of the selection procedure will be the preparation of a Record of Decision.

COMMENT NUMBER: 3

REFERENCE: Overall Comment (Page 11, Page 13, FS-1C1, FS-1J, FS-1B)

COMMENT: It appears the Army has already selected excavation and incineration as the remedial plan for RMA. Statements in the plan pre-judge the conclusions of the RI/FS program and suggest a technical bias toward premised, but not demonstrated, technical features of Option 1. For example:

- o "This area (ed.: railroad classification yard) will require excavation and contained storage."
- o "The required removal (ed.: of lower lake sediments)."
- o The first paragraph on Page 11 associates proposed strategy with 16MM cubic yards of contaminated waste and a one to two square mile containment facility, both of which are conceptual values or estimates developed in the decontamination assessment report for purposes of a cost estimate only.
- o "Selection of a rotary kiln incineration system" (FS-1C1).
- o FS-1J on-post pilot studies seem to anticipate only "conventional" technologies, i.e., incineration, and landfill in the final strategy components.

On Page 13 (second item), the Phase 1 program states advanced technology will be used to expedite the remedial action program. FS-1B states that a decision will be needed at the end of FY87 (sic) as to which (advanced) technology processes will advance to design criteria development and estimates 10 man years for advanced technology development in the 5-year Phase I period. Placing emphasis on timing coupled with the relatively low commitment of manpower to these

technologies, relative to "conventional technologies," virtually guarantees that advanced technologies will not be developed to a sufficient level to compete with excavation/ incineration/landfilling. Shell believes that the Office of Technology Assessment has the proper perspective, namely that:

"Cost-effective permanent cleanup technologies have not been developed for some problems, particularly for the extremely difficult (and possibly intransigent) problem of decontaminating entire aquifers. It will take time to demonstrate the effectiveness and costs for innovative technologies..."

From our review of the overall program we have the impression that the program anticipates that a single set of technologies, i.e., excavation, incineration, and landfill will emerge from the RI/FS portion as the appropriate remedial action for all solid waste sites. Although it is recognized that incineration and landfilling are the principal remediation technologies currently available, we believe that these technologies will have little, if any, demonstrable benefit to the public health, welfare, or environment, and could actually increase the threat to all. Therefore, other perhaps less developed approaches will be required. This may require that sites are not remediated in the timeframe projected by the program. Even so, the RMA site can be stabilized by insuring effectiveness of the boundary and monitoring systems and by steps already taken to ensure that pathways of exposure are mitigated or eliminated.

RESPONSE: This comment does present several valid concerns that require further explanation.

The objective of the program is to achieve cleanup of the Arsenal in a timely and cost-effective manner. A goal is to initiate cleanup activities by 1990. These objectives necessitate that a dual approach for selection of technologies be followed. This dual approach will consist of the assessment, evaluation, and refinement of conventional type technologies to provide information to support technology selection and design criteria development. At the same time, advanced technology assessment, development, and demonstration will be conducted to identify emerging or innovative technologies which are more cost-effective, will expedite cleanup, and can decontaminate sites and contaminants for which conventional technologies are not suitable.

Conventional technologies such as incineration and solidification will be examined for applicability of these technologies for overall cleanup or cleanup of specific areas, the types of systems best suited, the residuals following treatment, and preliminary cost and design information.

For example, Task FS-1C1 will be used to evaluate incineration technology including associated laboratory studies. An incinerator system will be chosen following this task. The rotary kiln, as an example, is the most widely used incinerator for destruction of contaminants in soils, sediments, and sludges.

As shown in the schedule for Task FS-1B, advanced technology development continues throughout the alternatives assessment. Potential new technologies will be screened, evaluated, and demonstrated. Those technologies which are considered applicable to site decontamination or cost-effective containment, will be further considered along with conventional technologies in the alternatives assessment.

It is agreed that many of these technologies will not be available for full-scale implementation until 1990. For example, in situ, microbial degradation may not be implemented during cleanup even if this technology is advantageous because the time to fully develop the technology precludes accomplishing cleanup using this technology within stated time goals.

A decision will be made at the end of FY87 which process(es) will advance to design criteria development DC-1I.

COMMENT NUMBER: 4

REFERENCE: Tasks FS-1B, PS-8, FS-1C4, FS-1G

COMMENT: As stated earlier, Shell believes that the technical program is excessive. However, some portions of the program do not appear to have sufficient effort allocated to perform the work described in the draft report. Among the items that appear to be understated are:

- o FS-1B Advanced Technology Development: 10 man years
- o PS-8 Criteria Development: 5 man years

We construe this task, along with endangerment assessment (8 man years) which had no task description provided, as being the one which addresses the question of "how clean is clean." If so, we believe significantly more effort will be required.

o Task FS-1C4 Air/Dust - 2 man years

We construe that this task addresses emissions except fugitive dust from all remediation activities including incineration, since we find no mention of this work elsewhere. We fail to see how this task can be completed at the same time (March 1987) that the Army selects a final remedial strategy. An understanding of incineration emissions sufficient to develop design criteria for emission control devices cannot occur until well into pilot studies of incineration (e.g., what is the fate of contaminants, especially metals in the incineration process as function of operating parameters?). Emissions control will be an integral and major portion of incineration studies. In our judgement the estimate of 2 man years seriously understates what will be required.

o Task FS-1G - On-post Removal and Transportation of Material: 1 man year

One man year seems too low. Also, how can a detailed waste materials handling program plan be completed by March 1986, even before a final strategy plan is defined?

RESPONSE: Agreed, that the presentation of resource estimates is confusing. The proposed level of effort for all the tasks scoped in the Phase I Plan is for work between now and 1989. The 10 man-years for Advanced Technology Development is for initial efforts between now and 1987. It is anticipated that an effort of at least 5 man years per year thereafter may be required for longer-term efforts.

The 5 man-year effort for the Endangerment Assessment is low. The estimate included only limited contractor support. However, this program involves significant EPA, USAMBRDL, and in-house efforts. On the same basis, we estimate the total effort to be 12 man-years. The Endangerment Assessment tasks are described in Task Numbers EA-1 and EA-2.

The write-up for Task FC-1C4, the study of air/dust control has been revised. The revised plan clarifies the purpose of this task which is to scope the technical and cost requirements for the alternative

assessments associated with dust and other airborne emissions resulting from excavation of soils and demolition of buildings and materials transportation. This effort does not include emission control systems or determination of pollutant fate of incinerator emissions or those associated with other treatment processes. Emission controls for incineration will be evaluated as part of Task FS-1J.

Again, with respect to Task FS-1G, this task is a scoping study for input on transportation and handling of materials to the alternatives assessment. The materials handling plan is part of the Design Criteria Development Tasks (DE-1J and DE-1K).

COMMENT NUMBER: 5

REFERENCE: Tasks RI-1B, RI-1C, FS-1C3, DE-1C, DE-1D, DE-2, OM-1A1, and OM-1A2

COMMENT: Certain tasks seem inflated or are estimated to require greater manpower than seems reasonable. For example:

- o RI-1C On-post Initial Ground and Surface Water Monitoring: 20 man years

We question why monitoring is required for FY86 with the volume of data already existing on RMA ground water and with the data being generated in other tasks, e.g., RI-1B.

- o Task FS-1C3 On-post Waste Water Treatment: 20 man years
Estimate seems excessive for scope or work defined.

- o Tasks DE-1C and DE-1D Boundary Systems and Alterations: 25 man years combined

There are many common elements in these tasks which would suggest that they be combined into a single task. The scope of these tasks involves straightforward engineering support. The effort allocation seems excessive; in fact, there is no rationale for this level of effort in the face of extensive alterations already made.

- o Task DE-2 Off-post Alternate Water Supply: 40 man years

This effort is excessive just for design if compared with the estimate in DE-1K of 100 man years for design of all on-post clean-up activities and facilities.

- o Tasks OM-1A1 and OM-1A2 Boundary System O&M: 83 man years

This effort equates to approximately 16.5 man staffing level which compares to 2-3 for O&M for Shell's Irondale boundary system.

RESPONSE: The resource estimates based only on manhours requires further explanation. Most of these estimates represent the total of labor, supplies, equipment, and laboratory support. The revised plan indicates tasks for which labor is not the only resource to be expended.

In Task RI-1B, on-post wells will be constructed in areas on RMA where contamination data are too sparse to draw conclusions on unsaturated zone contamination impact on ground water. In Task RI-1C, a core program of ground water and surface water monitoring will be conducted. This monitoring is in compliance with regulatory mandates (e.g., RCRA, cease and desist orders) associated with ground and surface water. The resource utilization is consistent with the litigation nature of the assessment and the associated analytical and quality assurance requirements.

Task FS-1C3 includes the evaluation of ground water, surface water, process water control systems, and by-product treatment and disposal not previously considered. Process water treatment will include scrubber water from incineration and washdown water from building and equipment decontamination. This level of effort is consistent with conducting feasibility studies and EPA's request to accelerate investigation of ground water treatment technologies.

Tasks DE-1C and DE-1D will be, in practice, consolidated. The resource estimate of 25 man years includes labor for an engineering assessment and for design and implementation. Also included in the estimate are costs for required equipment.

The resource estimate for Task DE-2 includes both materials supplies and labor for the off-post system. (Note: For planning purposes, construction of a new water supply distribution system is assumed.)

The estimates for Tasks OM-1A1 and OM-1A2 are high but include resources to operate, maintain, and monitor (e.g., laboratory and field support) the system. The North boundary and Northwest boundary system require three shifts per day of operating support. Methods and modifications to reduce operator attention while

maintaining the performance of control system and of treated water quality are being considered.

COMMENT NUMBER: 6

REFERENCE: Tasks FS-1I and FS-1J

COMMENT: A decision in March 1987 on the final remedial action strategy for submission to the MOA parties seems unrealistic and inconsistent with timing of other tasks. Allowing for preparation and review of the proposed strategy within the Army leaves barely more than a year from now to complete and analyze data from the remedial investigation; conduct and evaluate feasibility studies on all technical components; and develop, evaluate, and choose between alternative strategy options. Also, it is not clear how the timing relates to FS-1I, On-post Alternative Assessment, the stated objective of which is to select the most cost-effective and beneficial alternatives for abating contaminations on RMA (a task which extends to September 30, 1987). In addition, the decision appears to be made before the pilot operations, FS-1J, have been initiated. The purpose of these is asserted to be investigation of design criteria prior to any conceptual design efforts. Experience on the RMA suggests the pilot work should be done prior to a decision on a remedial action plan.

Task FS-1J, Pilot Operations, states that field scale pilot operations will be conducted during the period March 31, 1987, to September 30, 1989, to demonstrate the various final strategy components, e.g., excavation, transportation, treatment including incineration and landfill. Presumably, since these operations would result in actual cleanup, they would be of fair size and include necessary environmental controls. No mention is made, nor apparent time allowed for, the design, permitting, and construction of these facilities. Shell's experience indicates that these activities require at a minimum two years. Some of the strategy components, specifically incineration, involve very difficult technical problems and probably prototype designs, on-site process demonstrations, including associated environmental controls will be required. Since only 2.5 years are allowed for this task, little if any time is available for testing. We do not believe that completion is possible within the time frame provided.

If the Army wishes to pursue only the course of excavation, incineration, and landfiling, with which Shell obviously does not concur, then the work effort

should be more focused. The question of "how clean is clean" needs to be addressed now, so that cleanup criteria can be developed. Implementation of the pilot phase should commence in the near future so that the necessary information is developed to evaluate properly the applicability of the Army's chosen technology.

RESPONSE: The Army agrees that development of alternatives and pilot studies are concurrent tasks. The objective of the alternatives assessment is to evaluate all applicable technologies and remedial alternatives using the criteria of cost, environmental effects, acceptable engineering practice, and regulatory acceptance. Through this evaluation the technology or alternative method which is optimum for the remedial cleanup of RMA will be selected. Preliminary decisions will be made on types of equipment, sizing, throughput, and any required pilot and developmental studies.

Technology development treatability testing will be done during the development of and prior to final selection of a remedial action. The terminology the Army uses in referring to pilot studies may differ from that of industry.

The Army's technology development pilot testing program is comprised of three phases: 1. laboratory, 2. bench, and 3. field. The laboratory phases consists of basic applications testing to determine applicability of the technology such as carbon adsorption isotherms.

The bench phase further confirms technology applicability and develops parameters and criteria for conducting field studies. The size of the bench equipment is sufficient to be representative of the system used in full scale or pilot operations. For example, two-inch diameter columns were used for carbon testing at RMA.

Field testing is conducted using systems of either full scale or prototype size that are representative of full scale design and materials of construction. Typically, actual contaminated materials are used and tests are conducted at the site. Again, as an example, adsorbers leased from Calgon were used for carbon testing at RMA.

The observation that little time is allowed for conducting field scale pilot studies is valid. The timing proposed in the schedule is optimistic and is based on the assumption that the permitting process and permit approval will be expedited by the regulatory agencies. It is further assumed that pilot equipment of a representative type and size is available.

Transportable incinerators as well as other prototype or full scale process units are currently available. The 1611 furnace may also be suitable for evaluation of incineration. This furnace has been used to demilitarize agents and could be used as is or modified to decontaminate materials.

The question of "how clean is clean" does need to be addressed and Task PS-8, which is an ongoing task, is developing the action level for the contaminants.